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The 101st Annual Meeting of the American Statistical Association will be held in Philadelphia, Pennsylvania, December 27 to 30, 1939. With a few exceptions the sessions are open to the public.

Chapters of the Association have been organized in important cities in the United States. Information concerning the meetings of these chapters may be secured from the District Representatives listed on another page.

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THE TECHNICAL PROBLEMS AND LIMITATIONS TO THE CONSTRUCTION OF INDEXES OF PHYSICAL PRODUCTION

By Philip G. Hudson
University of Arizona

Although the movement to measure the physical volume of production is comparatively new,[1] certain important advances have been made in this art. More and more data have been discovered and utilized so that the more recently constructed indexes rest upon a much broader factual basis than the early ones. Certain pitfalls in the mathematical mechanics of index number construction have been recognized and to some extent avoided. At first the indexes were constructed only upon an annual basis, but shortly the time interval was reduced to a monthly basis and in some cases even to a weekly basis. In order to make the monthly and weekly indexes comparable within themselves, the constituent data are adjusted for seasonal variation and for differences in the number of working days.

Yet in spite of the progress that has been made, there remain so many technical problems and limitations that physical production indexes must be interpreted only with the greatest caution. It is the purpose of this article to analyze these difficulties, to suggest what is needed for their solution, and to appraise the most important modern indexes in the light of how well they succeed in solving these difficulties. Although many sub-indexes exist for the different types of physical production, the scope of this article will be limited to a treatment of the indexes of the general or total physical volume of production and their two most important component indexes: the physical volume of industrial production and the physical volume of basic production.

I. THE LACK OF COMPLETE DATA

The primary requisite for the construction of reliable index numbers is the availability of complete and accurate data. Complete coverage of all data, although preferable, may not be absolutely necessary, but at least a large enough sample must be obtained to be representative of the type of physical production being measured.

The United States Census of Manufactures is no doubt the most complete single source of production data. Although the census of 1933

[1] The earliest index based entirely upon physical production data was constructed by W. E. Leonard in 1913. This Journal, Vol. 13 (1912–13), 539–50. Otherwise the movement is entirely a post-World War development.

covered, except in a very few industries, at least 97 per cent of all the establishments,[2] it does not report physical volume data for all their products. Unfortunately for physical production indexes, this census is taken only biennially and its results are not very promptly available. The Census Bureau, however, does collect annual and monthly data on the production of many goods. Other bureaus of the Federal government do likewise, among which are the Bureau of Foreign and Domestic Commerce, the Bureau of Mines, the Bureau of Internal Revenue, and various bureaus of the Department of Agriculture. The fact that governmental records bear the stamp of being official is, of course, no absolute guarantee of their accuracy. While some are quite accurate, others are admittedly based upon estimates. In almost all cases some error of omission is present. This type of error offers no handicap to index number construction as long as its percentage remains constant, but unfortunately this is not always the case.

Another source of primary information concerning the annual or monthly production of particular goods is the records of large trade associations. Many of these have become very powerful and embrace a large proportion of the total output of certain commodities. They attempt to report the entire physical output of all the establishments within their respective industries, but at times changes in their membership complicate their efforts.

Neither the national government nor any private agency has ever undertaken a complete and systematic physical production census at annual and monthly intervals for the specific purpose of constructing a thoroughgoing production index. Because of the great expense of such a census, the makers of the various indexes have been compelled to make the best of whatever data they could discover and collect from scattered sources. These scattered data have been collected for various and sundry other purposes and are manifestly far from being all that is to be desired. It may be observed at this point, however, that the present indexes based upon the records of the government and of the trade associations are sufficiently comprehensive to be worthy of serious consideration.

Emphasis should be placed on one point relative to the collection of data on the physical output of individual goods. In a way there is a disadvantage to increasing the degree of thoroughness with which the various establishments in an industry are covered. If the degree of thoroughness is increased, the data will then overstate the true rate of production growth. It would be such a gigantic task to investigate this possible overstatement in all cases that its exact extent will probably never be known.

[2] *Biennial Census of Manufactures*, 1933, p. 3.

II. THE PROBLEM OF THE REPRESENTATIVE SAMPLE

We may now shift our attention to inquire whether the data exist for a sufficiently large number of goods to make index numbers that will be truly representative of the composite change in industrial, basic, or general production, as the case may be. The ordinary tests for the representativeness of the sample, such as the standard error of the mean and the stability of the average, are very difficult to apply to the actual indexes. It is even doubtful if there is a logical basis for applying these tests in this case. These tests would do very well in determining how representative the height of a given group of soldiers is of all the men in an army. Human growth may be expected to react collectively in a similar fashion because all humans are examples of the same type of organism. No such common basis, however, can be assigned to the production of all types of goods. It would seem in this case that no sample short of complete coverage can be defended as entirely adequate. If the available sample were to cover the changes in physical production representing one half of the value of all goods produced, there would be no definite assurance that it would be at all representative of the other half.

In actual practice, the choice of the sample for the construction of physical production indexes has almost entirely been conditioned by the availability of the data. The mere fact that the data have been collected and are available is in itself no guarantee that they are equivalent to the unbiased results of an adequate random sample, but neither does it imply that they are not. A large sample is not necessarily more representative than a small one, but other things being equal, it should be. Baffling as may be the problem of knowing what constitutes a truly representative sample of physical production, one point at least is certain. The larger a sample becomes, the less is the opportunity for an unusual fluctuation in a single item to influence unduly the average of the whole.

Most of the recent production indexes have increased the scope of series covered considerably beyond that of the earlier indexes, and hence they are likely to be based upon samples that are more representative. Warren and Pearson's indexes of total basic production include a total of 63 series which include practically all the reportable basic production in their four sub-groups of crops, forest products, fuel and power, and minerals and secondary metals. Livestock are omitted because they are produced largely from crops (except pasture), which are already once included.[3]

The Day-Thomas census index of manufactures, with its 137 indi-

[3] Warren and Pearson, *The Physical Volume of Production in the United States*, Cornell University Agricultural Experiment Station, Memoir No. 144, pp. 51–57.

vidual series, has been estimated to cover directly more than half of the total value added by all manufacturing.[4] The indexes of industrial production of the Federal Reserve Board,[5] of the Standard Statistics Company,[6] and of Y. S. Leong[7] each are based upon 60 or more series and hence provide a fairly complete coverage of all manufacturing annually and monthly since 1919. The index of the Federal Reserve Board has been estimated to cover indirectly about 80 per cent of the value added by all manufacturing. The Standard Statistics index has about the same coverage. Leong estimated that his total series cover 50 per cent of the total value added by manufacture directly and 87 per cent indirectly. These percentages refer to the total of all value added by manufacture reported by the Census Bureau. Since the census has already been pointed out as very complete, it is evident that some of the modern indexes of industrial production are based upon samples that should be large enough to be fairly representative of all industrial production. Not all the census data can be used because the data for some goods are not sufficiently homogeneous.

Of the recent indexes of the physical volume of general production, Barron's index of crop production, industrial production, and trade[8] and the Brookings Institution's index of the composite physical volume of production[9] have the broadest coverages. Of the two, Barron's is somewhat the broader because it includes electric power, railroad freight traffic, and building construction in addition to manufactures, minerals, and crops; but the inclusion of these items introduces a greater problem of weighting.

Another aspect of the problem of obtaining a representative sample is the question of when to add new industries to the list used in making the index and when to drop old ones. At any given time the whole pattern of physical production growth consists of a large number of individual rates of growth in the production of all the different goods. New industries constantly spring up and exhibit rapid rates of growth while they take their place in the economic structure. Other industries become displaced in importance and some are discontinued.

In the absence of a specific unit for the direct measurement of production in terms of utility created, this changing nature of the pattern

[4] Day and Thomas, *The Growth of Manufactures, 1899–1923*, U. S. Census Bureau, Monograph No. 8, p. 98.

[5] Thomas, W., "Construction of an Index Number of Production," This JOURNAL, Vol. 22 (1927), 320–330.

[6] *Standard Trade and Securities, Statistical Section, 1936*, Section D, p. 36.

[7] Leong, Y. S., "Indexes of the Physical Volume of Production of Producers' Goods, Consumers' Goods, Transient Goods, and Durable Goods," this JOURNAL, Vol. 30 (1935), 364.

[8] Persons, W. M., *Barron's Indexes of Business since 1899*, Barron's Publishing Co., New York, 1937, no pagination.

[9] Nourse, E. G., "*America's Capacity to Produce*," The Brookings Institution, Washington, 1934, p. 547.

of production offers a more serious handicap to the construction of physical production indexes than may at first be apparent. Consider, for example, the extreme case of a 100 per cent change in the pattern of production in which, at a certain time in the future, a totally new set of goods had succeeded in displacing all the present known goods. Obviously the initial and final figures of an index which covered the whole period while this complete change was taking place would be totally uncomparable. Of course so complete a change has little practical significance, but in so far as the pattern of production does change, the total physical outputs of different periods of time are not strictly comparable. The longer the period of time that a physical production index covers, the less valid are the comparisons between the more widely separated time intervals. What may constitute a representative sample at one time will not indefinitely remain so.

As well as the present writer can determine, there is no way to escape this difficulty except by devising a psychological unit, or some kind of unit, by which utility can be measured directly. Such a unit would provide a common basis for summating the heterogeneous units of all types of production just as the bushel makes it possible to summate the production of wheat on all farms. It is perhaps unscientific to say that such a unit is impossible to devise, but at least there seems to be little likelihood of immediate success. In the meantime some of the more recently constructed production indexes are to be examined to see how they have handled the problem.

In actual practice the addition or the subtraction of particular commodity series from the list of all those combined into the index has been conditioned more by the availability of data than by the starting of new industries and the cessation of old ones. In the Federal Reserve index of manufactures three of the original 60 items, namely oak flooring, face brick, and paving brick have been excluded and the index recalculated for the entire period. In addition several other series were revised, but the original final results were unaffected.[10] In October, 1931 the copper series was dropped from the Federal Reserve index of minerals.[11] Although the Babson index of manufactures covers the period from 1904 to the present, the thirty-odd series upon which it was based in 1937 are all continuous only since 1923.[12] The index of industrial production of the Standard Statistics Company was based on 64 series in 1936. It extends back as far as 1884, but the data prior to 1920 are very meager. All 64 of the series are continuous only since 1923, with the exception of the copper series which was dropped in

[10] *Federal Reserve Bulletin*, March 1932, p. 194; Sept. 1933, pp. 584–585; and Nov. 1936, p. 909.
[11] *Ibid.*
[12] Information furnished through the courtesy of Mr. H. C. Baldwin of Babson Reports, Inc.

1932.[13] In the Warren and Pearson index of total basic production the data for all the crops are not very complete prior to 1904 nor for the forest products and fuel and power series prior to 1910. The "water power other than electric" series is very incomplete at all times.[14]

These additions of new series to the various indexes for the more recent portion of the periods covered do not arise from the fact that a great many of them represent wholly new products, but rather because the data are not available any earlier. In the indexes of industrial production the only important exception since 1900 has been the addition of automobiles and trucks. The old wagon and carriage industry was seldom used at all. Copper is the only old industry of any consequence that has been dropped. Thus in actual practice modern production indexes reflect changes in the output of substantially the same goods. The only difference is that the sample has been increasingly widened in scope for the more recent years.

Of course the fact that few new industries were added and few old ones dropped does not solve the problem of the changing pattern of production. It only sidetracks it. The tendency in keeping a production index up to date is to follow the same routine and to use the same old established sources of information. The failure to include new methods of recovering by-products and the rapidly growing new industries serves to introduce a downward bias in all indexes which purport to represent all production. On the other hand, if the new industries were included, the index must of necessity be recomputed upon a new base and the results for the early years which did not contain the new industries would not be comparable with those of the later years which did. This is a dilemma from which there seems to be no means of escape. A compromise would be to revise the list of series used as a sample at least once each decade and to recompute each ten-year index series upon its own base. This would mean the end of production indexes covering long periods of time, which is something that they cannot with strict logic do anyway. Physical production indexes, when they do cover long periods of time without changing the list of products covered, should be considered as indexes of the collective change in the output of those particular products rather than of all industrial production, basic production, or total production, as the case may be.

III. THE PROBLEM OF MATHEMATICAL BIAS (WEIGHTS AND AVERAGES)

Another major problem in the construction of any index number is the selection of a satisfactory mathematical formula. The formula must combine the component series into single index numbers that are truly

[13] *Standard Trade and Securities, op. cit.*, pp. 25 and 36;
[14] Warren and Pearson, op. cit., pp. 40–49.

representative of the changes in their composite magnitude. This involves the use of the proper system of weights and proper type of average in order that the results will meet certain mathematical tests of soundness.

As in the case of most index numbers, when the component series are not of equal importance, it becomes necessary to assign weights to the individual items in order that they may exert their due influence on the average. The determination of the relative importance of each item should not be left entirely to the discretion of the individual making the index but should rest, as far as possible, upon some objective standard. In the making of physical production indexes three standards for weighting have been used: the number of workers employed in the industry, the amount of power used, or the market value of the products ("value added" in the case of manufactures). The first two of these standards have largely been abandoned in favor of the third, which is no doubt a reasonable decision because market value is the most closely associated with production in the theoretical sense of utility creation.

The value weights, however, are by no means perfect indicators of the relative economic importance of the various goods because they fail to take into account that portion of the total utility of goods known as consumers surplus. The market prices of goods tend to reflect their marginal utilities. Thus when the output of a relatively new manufactured product is expanded, its market price commonly falls. This, then, gives a lesser importance per unit to the greater output. From the standpoint of the economic importance of the product, the phenomenon of diminishing utility should be permitted to assert itself, but at the same time it is not logical to lose sight of that portion of the total utility of a product known as consumers surplus. As prices fall, the consumers surplus comprises an increasingly larger proportion of the total utility of a good which approaches 100 per cent as price approaches zero.

For relating, without bias, the physical output of any given year to that of a base period, Professor Irving Fisher has recommended a compromise system of weights, which permits the fixed weights of the base period and the variable weights of the given years to exert an equal influence on the final index. Some authorities contend that it scarcely seems logical that a satisfactory method of weighting can be devised from two imperfect methods, but Fisher has ably demonstrated that his "ideal" index meets certain mathematical tests of soundness. While no system of weights seems to be entirely free from criticism, the weights based on value (or "value added") should by all means be

superior to guesswork. They should likewise be superior to assigning no weights at all or, to state it more precisely, to assigning an even weight to all items regardless of their relative importance.

Professor Fisher likewise experimented extensively with the use of various types of averages in index number construction. His findings are so well known that it would be trite to repeat them here. Since the publication of his book in 1922 on *The Making of Index Numbers*, the makers of many production indexes have recognized the merits of his ideal formula, but they have often been unable to secure all the data necessary for its strict application. Some, however, have succeeded better than others.

The Babson index of manufactures, the most important component of the Babson index of business volume, is computed by a formula which resembles Fisher's ideal more closely than that of any other index. It is a geometric mean of two aggregatives—one computed with fixed weights; the other with variable weights taken from the most immediate year of the Census of Manufacturers. The results should conform very closely to the reversal tests, and Fisher would rate this formula as "excellent" if not "superlative."[15]

The Federal Reserve index of industrial production is computed in a manner similar to that of the Babson index for the years 1919–1923, but for the period since 1923 an aggregative formula with fixed weights had been used. This formula is rated as "very good."

In the construction of Barron's index of crop production, industrial production, and trade, full use is made of the ideal formula in combining the five constituent sub-indexes. Barron's has the distinction of being the only major physical production index which does so, but detraction in merit arises from the fact that the sub-indexes are not constructed by the ideal formula.

The indexes of Warren and Pearson, the Standard Statistics Company, and the Brookings Institution are computed by a weighted-arithmetic-mean-of-relatives type of formula. When the arithmetic mean is used with a system of base year weights, its characteristic upward bias is tempered by the characteristic downward bias of the fixed weights. Fisher rates such formulae as "very good."

At this point it is well to emphasize that the preceding criticisms apply only to the type of formulae used. Fisher's ideal formula meets the reversal tests, but it is not "fool proof;" that is, mere use of this formula will not guarantee a reliable index number. It is only a reliable mathematical method for combining what data one has at hand.

[15] See Fisher, Irving, *The Making of Index Numbers*, pp. 244–247, for a rating of all formulae with respect to their conformity to the reversal tests.

Trustworthy results can be consistently obtained only from data that are accurate and representative. Even though a poor formula is used, good data may be combined into a more reliable index than can be obtained from poor data by the ideal formula. A relatively large number of formulae will yield results which conform closely enough to the ideal for all practical purposes, but good data should not be dissipated by poor statistical methods. Fortunately, since the early stages of the production index movement, the improvements in data and the adoption of better statistical technique have proceeded apace with each other.

The significance of the word "bias," as it has thus far been used in this article, also needs special attention. In an earlier section, the failure to include rapidly growing new industries was mentioned as a factor which caused considerable downward bias in the current production indexes. This bias is not exactly parallel to the mathematical bias which results from certain types of formulae. In the former case, the bias refers to the overstatement or the understatement of the true rate of growth shown by the trend of the index as a whole. A formula with upward bias, however, may or may not introduce upward bias in the rate of growth shown by the entire index. The determining factor is whether the base for comparison is near the end or near the beginning of the period covered by the index. If the base is near the beginning, a formula with upward bias will cause the entire index to have a cumulative upward bias in its rate of growth. But if the index is recomputed with the base near the end of the period, cumulative downward bias in the whole index is the result. The reverse, naturally, is true for formulae with downward bias.

IV. THE LACK OF COMPARABLE STATISTICAL UNITS

In none of the product indexes that are currently available has any thorough attempt been made to adjust for the changes in the quality of products or in the methods of utilizing them. This difficult problem assumes several aspects. Consider, first, the utter lack of homogeneity in the units of physical goods produced by many important industries, both as of a given firm and as between different firms in the same industry. In fact the engineering firm which manufactures engines and special types of mechanical equipment on a custom or job-lot basis may not even have a common name for the heterogeneous units of its own output. Greater still is the variation between the products of different companies. Secondly, even if a product retains the same name over a period of time, the name may be the only feature which remains constant. The quality of almost any good is subject to some amount of

change. Engineering standards are constantly being improved both in physical design and chemical content. Gradual improvement is to be noted in agricultural products. Some of these changes may be so small that they may be safely ignored over relatively long periods of time, but others rapidly assume large proportions.

In general the indexes of the physical volume of basic production are relatively much less handicapped by the changes in quality of their physical units than are the indexes of industrial production. A bushel of corn in 1900 was not very different from a bushel of corn in 1936. The different breeds of livestock have been greatly improved in the last two or three centuries, but the process has been gradual. Quality changes in the major crops and types of livestock do not seriously handicap the construction of basic production indexes covering the last thirty or forty years. With regard to the changes in quality of the products from the extractive industries of lumbering and mining, a slight decline in quality may in some cases be detected which will tend to offset the gains in quality of products from the genetic industries of animal husbandry and horticulture. A pound of copper will always be qualitatively the same, but other products of the mines and forests are not so constant in their chemical and physical content. It is only natural that the best hardwood forests and the best grades of coal should have been appropriated first. Now, since the better grades of coal and lumber are accessible only at greater expense, more of the poorer grades are being used. Hence the average board foot of lumber or ton of coal extracted in 1936 were not of quality as good as those of 1900. This statement, of course, applies to these products only in their unprocessed state.

In the case of industrial production it is quite clear that the problem assumes much greater proportions. Some type of adjustment must be made for the series in which the quality of the physical unit has undergone great changes if a true picture of the changes in the volume of industrial production is to be given. Improvement in quality often takes the form of greater durability. Thus it could be possible for the actual number of physical units to decline and yet have the smaller output yield a greater number of "physical uses." It is doubtful if a use can be physical in the literal sense, but the expression is retained in order to differentiate the physical production concept from the utility production concept. The effect of changes in the quality of goods on the utility they yield is quite a different matter. The present point remains, however, that physical goods must be considered from the fundamental standpoint of the number of uses they render. Otherwise, the improvements in quality, which take the form of increased dura-

bility, are certain to cause the indexes to understate considerably the true rate of physical production growth. Not all the changes in quality are concerned with increasing the number of uses that each unit of a good is capable of rendering. Some quality changes alter the convenience, comfort, or fashionableness of the goods. Such changes are much more closely related to the utility afforded by the good rather than its mere physical output.

Closely akin to the question of the increased durability of goods is the matter of improvements in the technique of utilizing goods. Changes in furnace design have considerably increased the amount of heat yielded by a given quantity of fuel. Improved technique in making concrete has helped bring about economy in the amount of cement needed to produce concrete of a given strength. A long list of such examples could easily be prepared. Obviously the ability to extract more uses from a given amount of material, unless taken into account and the proper adjustment made, imparts a downward bias to production indexes just the same as does the improvement in the quality of the material itself.

In an effort to give some idea of the combined extent of these two sources of downward bias in the case of a specific commodity, some pertinent data about cement have been assembled. Although its outward appearance has not changed a great deal, a barrel of cement produced in 1936 is chemically and physically much superior to the same amount of cement produced two decades previously. Likewise improvements have been made in the technique of mixing and pouring concrete. The long time tests of the Portland Cement Association show that at twenty-eight days of age the best concrete made from the average cement of 1936 is more than twice as strong as the concrete made from the same amount of average cement produced in 1916 to 1920. At one year of age, however, it is only slightly more than half again as strong. Judging from the results of other tests made on cement produced during the intervening years, the relative advantage of the modern cement will become still less in tests made at two, five, and ten years of age.[16] It seems that under proper conditions, all concrete will continue to grow in strength for as long as ten years after it has been poured and that the concrete made from the older cements was relatively so much weaker in the early stages largely because it needed a longer time to harden. In actual practice, of course, contractors cannot wait a year for their concrete to attain a specified strength. Twenty-eight days is a common time limit in construction contracts. At this age, as has been

[16] These statements are based on data furnished to the author through the courtesy of Mr. F. R. McMillan, Director of Research, Portland Cement Association, Chicago, Illinois.

pointed out, the strength of 1936 concrete is at least double the average concrete of 1916–20. Thus only half as much cement is needed in order to meet a given specification of strength. Therefore, when a barrel of cement is regarded in the more ultimate sense of a certain amount of concrete of a given strength, one barrel of cement produced in 1936 is the equivalent of two barrels produced in 1918.

For some classes of work, 20 to 25 per cent more concrete is now being produced per barrel of cement than was the case twenty years ago.[17] This concrete is not twice as strong at twenty-eight days of age because it is made with a leaner mixture of cement. But what is lost in strength is gained in volume so that the conclusion that one barrel of 1936 cement is the equivalent of two barrels of 1918 cement is not invalidated. No effort has been made to maintain the strength of concrete constant and to maximize the volume by using a leaner and leaner mixture of cement.

The adjustment for the increased number of uses per unit of physical production will have some very interesting effects on the indexes of physical production growth. In 1918 the output of Portland cement was approximately 71 million barrels. In 1936 it was approximately 112 million barrels. If the quality of cement and the technique of pouring concrete had remained constant, this would represent an increase of 58 per cent in eighteen years or an average annual rate of increase of 2.6 per cent. But when we consider a barrel of cement in the fundamental sense of a certain amount of concrete of a given strength, then the 112 million barrels of 1936 cement become the equivalent of 224 million barrels of 1918 cement. On this basis the output in 1936 represents an increase of 215 per cent in eighteen years or an average annual rate of increase of 6.6 per cent.[18]

Such a marked improvement in quality has not been characteristic of all the products which enter the physical production indexes. In some instances, as in the case of certain types of clothing, the durability or number of uses per unit may have declined. Appropriate adjustment should also be made for these changes. While the evidence at hand is not complete enough to support a precise statement, it seems reasonable to conclude that the net effect of the adjustments for the changes in the durability of all goods would reveal that the present

[17] *Ibid.*

[18] This method of adjustment is primarily illustrative. It is admittedly an imperfect portrayal of the actual gains from the improved quality of cement and the improved methods of handling concrete. Some cement is used to make concrete many times stronger than necessary and thus the gain from the improved cement is wasted. On the other hand, modern concrete makes certain types of construction work possible that formerly could not be undertaken at all.

indexes understate considerably the actual rate of physical production growth.

Failure to include services has sometimes been listed as another factor which introduces downward bias in physical production indexes. Strictly speaking, services are not physical production and their exclusion should not be conceived as exerting any bias upon physical production *per se*. Since it appears in many cases that changes in demand have shifted energy from the production of goods to the production of services, the indexes of physical production will tend to understate the growth of real income which, of course, includes services as well as goods.

V. CONCLUSIONS

Throughout this article several factors have been analyzed as causing physical production indexes to understate or overstate the true rate of change. A summary and classification of these factors follows:

I. Factors which cause upward bias.
   1. The gradual decline in the quality of the products from certain extractive industries and, in some cases, in the quality of manufactured goods.
   2. Mathematical upward bias from the type of formula used and from the base year chosen.
   3. Increased thoroughness in the collection of data.

II. Factors which cause downward bias.
   1. Gradual improvement in the quality of agricultural products and considerable improvements in the quality of many manufactures.
   2. Improved methods of utilization which make possible the extraction of more uses from the same amount of material.
   3. Failure to include by-products and rapidly growing new industries in the sample used in making the index.
   4. Mathematical downward bias from the type of formula used and the base year chosen.

Unfortunately no common basis can be found for assigning weights to these two sets of opposing factors, but the writer feels confident in asserting that the group making for downward bias considerably outweighs the other. In other words, when the present physical production indexes show a positive rate of growth, they do so in a very conservative manner.

PRICE REDUCTION AS A STIMULUS TO SALES OF DURABLE CONSUMERS' GOODS*

By Don D. Humphrey
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As a remedy for economic ills, no other single proposal has been so frequently or persistently urged by professional economists during the past 150 years as price reductions. At its very inception as an organized body of principles, as distinct from the special pleadings of the merchant class, economic theory was dedicated to the destruction of monopoly. Price reduction has been and remains the economist's panacea. Hitler was not the first man who wished to change the ancient greeting, "Good Day." More than a decade ago, Walton Hamilton advised industrial laborers to substitute for the usual "Good Morning" or "Good Day" which they inherited from their agricultural forebears, the more appropriate greeting, "Low Prices."

IMPORTANCE OF CONSUMERS' CAPITAL

First, I wish to stress the importance of consumers' capital. Most analyses of investment proceed in terms of the interest rate, reduction of cost, and anticipation of profits; they are preoccupied almost exclusively with producers' capital. Mr. Kuznets' recent estimates, however, indicate that durable consumer goods are the largest item in gross capital formation. Measured in terms of dollar volume, 1919–35, the average annual value of durable consumer goods, *excluding* building, was $7.2 billion, or almost one-fourth of the gross capital figure. This is 50 per cent more than the $4.8 billion average annual value of durable producer goods during the same period. If repairs and maintenance are excluded, durable consumer goods constituted almost one-third of the total capital formation during the period which Mr. Kuznets reviewed. As a field of saving and investment, consumer goods rank above producer goods. Nor is the importance of consumers' capital limited to its relative size. It is, also, strategically important because of the so-called principle of acceleration.

The analysis of business capital formation (e.g., reduction of interest and wage rates) does not directly fit consumer investment, as the latter is not guided by entrepreneurial profit calculations. A reduction in interest rates, wage rates, and other costs does not, therefore, bear exactly the same relation to the formation of consumers' capital as to the formation of producers' capital. Over the short run, consumers'

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incomes usually play a more important role in their purchasing than do price adjustments.

EMPLOYMENT IN 90 MANUFACTURING INDUSTRIES

Let me summarize the cyclical behavior of 90 manufacturing industries. Employment rather than production has been used because data were available for a larger number of industrial divisions. (There may be some technological displacement in these figures, but it does not, I believe, change the general picture.) In the depression following 1929, the median decline in employment in 32 durable consumer goods industries was 41 per cent; the range was from 10 to 77 per cent. This compares with a 63 per cent median decline in 35 durable producer goods industries and a range from 32 to 88 per cent. In these statistics I have included the semidurable items, such as clothing, in the durable category. If only the durable items are compared (such as automobiles, radios, jewelry, and furniture), the average decline in durable producer goods is but slightly greater than that in durable consumer goods. In contrast to both durable categories, the median decline in 23 nondurable goods industries was 30 per cent, with a range from 12 to 61 per cent.

In the recent precipitate drop during 1937–38, in both durable consumer and durable producer goods industries the median drop in employment was around 30 per cent, while in the nondurable goods industries the median drop was only 12 per cent. The range was from 5 to 31 per cent in nondurable, 7 to 60 in durable consumer, and 13 to 66 in durable producer goods industries.

The declines of both 1923–24 and 1927 were similar to that of 1937 in that there were no marked differences between the durable goods categories. Comparative analysis of this sort justifies the following generalizations:

(1) In case of minor depressions the behavior of employment in durable consumer and producer goods industries is quite similar, but in major depressions the differentiation is marked when the semidurable items, such as wearing apparel, are included in the durable consumer category. When these are excluded the behavior in the consumer group is about the same as in the producer group.

(2) There is, of course, a marked difference of decline between the durable and nondurable goods industries in both minor and major depressions.

(3) From this general picture durability appears to explain the similarities and differences in the cyclical behavior of manufacturing industries and is definitely a more significant factor than whether the

goods are in the producer or consumer category. The observations on this subject at these meetings three years ago seem confused: "... I am in complete agreement with Colonel Ayres ... He observes how the volume of consumers' goods has held up while prices declined severely, and how the volume of producers' goods has declined greatly while prices declined little. He then says, 'If anyone could devise a means to make durable goods follow the pattern of consumers' goods in volume and prices during depressions, he would have found the solution of the depression ...' "[1]

In 59 of these 90 industries for which price data were obtainable, one does not find that striking inverse correlation between production and price declines which has occasioned so much comment in recent years.[2] There are, to be sure, industries in which employment declined a great deal and price very little, but there are also many industries in which both price and employment dropped sharply. However, the question of whether or not price reductions *would* maintain production and employment cannot be definitely proved by this type of statistics. If, when sales fell, price cuts were made *immediately* in such a manner as to reach consumers without starting a cumulative deflation by causing postponement of buying in anticipation of still further cuts, they would be beneficial in two ways:

1. Consumers' real income would be increased directly.
2. Savings would be reduced through business losses.

My conclusion is that, as a secular or long-term question, price reductions do increase the purchase of durable consumer goods; but as a cyclical question, the answer depends upon numerous special circumstances. *General* price reductions will often be ineffective in stimulating sales directly, once the deflationary wave of a depression is under way; in fact, they may reduce sales for a time. But to ask the question in this way is to misplace the emphasis for price reductions that redistribute income in such a way as to reduce savings are beneficial whether they stimulate sales directly or not.

THE DEMAND SIDE

Beginning from the demand side, secular price reductions are likely to be more effective than cyclical ones because the basic patterns of consumption change but slowly. A price adjustment that is effective over a generation may not be effective overnight. The loss of income among consumers, or the prospect of loss, is often more important

[1] *American Economic Review*, Supplement, March, 1936, p. 67.

[2] Since the above was written, The National Industrial Conference Board has published an extensive investigation of correlations between price changes and production changes. See Jules Bachman, *Conference Board Bulletin*, Vol. XIII, No. 5.

than the elasticity of demand in the strict sense which assumes aggregate income to be fixed. Durability of the product becomes important when consumers of durable goods suffer a 10 to 20 per cent reduction in money income, and the effect on sales may well be, not a 10 to 20 per cent reduction, but no replacement sales at all. If the consumers' capital is regarded as yielding a series of services and the depreciation as being from 10 to 20 per cent, rationality requires the postponement of replacement buying. In order to effect replacement demand, a price reduction will often need to be of greater proportion (depending upon the rate of depreciation) than the loss of consumers' income.

The demand for *new* consumers' investment may often be inelastic because of the joint demand for other goods. A precipitate drop in the expansion of automobile sales will in itself slow down the sale of tires, tubes, batteries, heaters, and other automobile accessories. In a large area of the economy, some of the most important durable consumer goods are dependent upon public investment in roads and in power plants. A few years ago, the demand for automobiles in many areas was retarded by bad roads while, at the present time, the demand for most radios and other electrical appliances on the part of a large section of the rural population is contingent upon rural electrification. In this area, the effectiveness of price cuts is still more narrowly circumscribed; the collapse of investment in producers' capital adversely affects the demand for consumers' capital in a way which no amount of price cutting in consumer goods can remedy.

"As compared with the demand for consumers' goods, we are inclined to think of the producer goods market as being relatively inelastic," say Nourse and Drury. Admitting the derivative character of the demand for producers' capital, they explain its greater inelasticity as follows: "It is obvious that railroad executives do not lay down new rails or replace locomotives or cars just because they are cheap. The time for discarding old equipment is determined by engineering considerations, possibly accelerated by Interstate Commerce Commission requirements as to safety, by general business conditions, by the financial position of the road, and by the ability of the market to absorb equipment trust certificates."[3] But the most important durable consumer goods—automobiles, mechanical refrigerators, furniture, and radios require financing no less than producers' capital. The condition of the finance market or the ability to obtain credit at all is a vital factor affecting sales—a more important factor at times than small price concessions. Consumer financing has often been handled in the past in a way which increases instability. Just as the demand

[3] *Industrial Price Policies and Economic Progress*, pp. 120–121.

for producer goods is conditioned by the "financial position of the road," so the purchase of durable consumer goods is similarly affected by the financial status of the consumer, which varies, as does that of business, with cyclical ups and downs. Durability of product affects the timing of discarding old equipment, and repair costs are balanced against the price of new goods in durable producer and consumer goods alike. Thus I think that the difference between durable consumer and producer goods is not so great as Nourse and Drury suggest.

A further factor, which I introduce rather as a question, concerns the indivisibility of the product. Price changes, in order to be most effective, require divisibility of the product. Fine marginal calculations are impossible in the purchase of goods where one buys either a single unit involving a large outlay or none at all. The most important durable consumer goods normally involve a single large expenditure. One buys a house, a car, an electric refrigerator, or a davenport. He cannot, usually, buy five dollars' worth. Indivisibility is, admittedly, overcome to some extent by joint ownership, hire, and second-hand goods. But, in considering the comparative effectiveness of price reductions on shirts and on automobiles, for example, is indivisibility a factor? Lower priced shirts may induce one to buy without the necessity of replenishing his entire stock of shirts, but in the case of an automobile it is all or nothing.

There is not time enough here to discuss the whole question of liquidity preference, but in an unstable world where we have become habituated to daily pulse-taking, I would attribute a great deal of importance to changes in the desire for liquidity. The price concession must be adequate to induce the buyer to part with liquidity or to mortgage his future income at a time of great uncertainty. Price cuts must overcome not only the propensity to hoard, but also the speculative attractiveness of old securities at depression prices.

One of the most important short run considerations is that price reductions may beget *anticipation* of further reductions and create more uncertainty and fewer sales. The immediate effect of price changes upon sales is greatly affected by specific local conditions. At times, *rising* prices are favorable to sales and falling prices lead to postponement of orders.

These factors, such as durability of product, joint demand, changes in credit conditions, loss of income, changes in liquidity preference, and uncertainty regarding future prices, create a short-run condition where demand for consumers' investment may be decidedly unresponsive to price reductions. There may be times, of course, after the deflationary wave has spent itself and after favorable reforms have

been inaugurated, when price reductions will be effective. They may be effective if adopted at the first signs of depression and publicized as effective for a "limited time only." The picture I have just drawn doubtless overstates the case, but I think that economists are prone to exaggerate the beneficent effects of price reductions because, perhaps, of the tendency to apply, inappropriately, an essentially long-term analysis to a short-term problem.

THE SUPPLY SIDE

Let us now consider, briefly, factors affecting the sellers' attitude and the character of the supply curve. There are two quite different things to be explained: first, why the sellers wish to maintain inflexible prices, especially during depression; and, second, why they are able to do so. The most effective monopolist would change price with any change in either cost or demand; his price changes would be as frequent though not so great as changes in competitive price. Sellers believe, however, that price cuts often have a negligible or even adverse effect upon sales owing to the factors mentioned above as well as to consumers' ignorance of the change or the belief that the quality of the product has been impaired.

The *belief* that price cuts will not materially improve sales is sufficient to explain why sellers desire rigid prices. But even if demand were considered elastic, there are additional reasons why sellers fear price cuts: (1) Some prices are widely advertised and changes are costly. (2) There is danger of disturbing arrangements for resale price maintenance and oligopolistic price-making. (3) There is a fear of consumer resistance to raising prices once they have been lowered. (4) Many costs are rigid. (5) Inventory losses are highly important in some lines. In automobiles, large price reductions would bankrupt many dealers who are heavily loaded with second-hand cars. (6) The seller himself is in a fog, and inertia results from the lack of clear reasons for positive action. He often underestimates the seriousness of the maladjustment and, in addition, misunderstands it.

The fewness of sellers is basic, of course, in making possible price rigidities. But I would stress also the differences between the markets for raw materials and for finished goods. For even with a large number of sellers, the market for finished goods, in contrast to the market for raw materials, is filled with non-economic and irrational factors. Buyers are deplorably ignorant. Consequently, price is a less effective regulator.

Differentiation of product enables sellers to tap various levels of the

demand curve and from their point of view reduces the desirability of *general* price adjustment.

GENERAL OBSERVATIONS REGARDING RIGID PRICES

The economist advocates price reduction as a means of maintaining output. The businessman is interested, however, in a different question: his concern is with the effect of price reduction upon *his* sales. To say that a reduction in price will be beneficial to the entire economic system is quite different from saying that it will increase John Smith's sales next month.

The recent Brookings study by Nourse and Drury seeks to educate the businessman in the path of lower prices,[4] but the scope is limited to long-term problems arising from technological change. I suggest, however, that the stamp of approval which was given big business[5] in this study is unwarranted until a comprehensive evaluation has been made of the cyclical effects of industrial price policies, which are, after all, the pressing problem.

I must refer now to the discussion of rigid prices which has claimed so much attention, but which still suffers from ambiguity.[6] Prices may be rigid with regard to: (1) the cost of production (attention may be centered upon raw material costs, labor costs, or capital costs); (2) changes in demand which result from a decline in aggregate income; (3) secular changes in the structure of production; (4) comparison with other prices; for example, agricultural prices are flexible as compared with industrial prices, or raw material prices are flexible as compared with prices of finished goods. Usually, of course, there is a combination of two or more of these meanings.

Professor Mason has analyzed price rigidity as a statistical, as an analytical, and as a normative concept[7] and I need not review his able treatment here. If the breakdown of the system is to be attributed to the greater rigidities in commodity prices, it must be on the ground, not that there are more rigidities, but that other changes in the system have made the rigidities more significant. But as a short-term analysis, we must recognize that the old economic system has a very substantial, though irregular, record of expansion for many decades despite the indisputable fact of rigid prices.

[4] One reviewer paraphrased the thesis of *Industrial Price Policies and Economic Progress* thus: "Be good, big boy, let who will be high priced." This study is concerned entirely with what Mr. Means has called administered prices, prices born not in the market place but the in office chair.

[5] See especially pp. 266–267, 269–270.

[6] On a basis of the measure of rigidity employed by Gardiner Means, prices are more more rigid now than in 1890 though they may, of course, be more significant. See, "Nature and Meaning of Rigid Prices," *Journal of Political Economy*, Oct. 1937, by the present writer. Compare Means, "Industrial Prices and Their Relative Inflexibility," *Sen. Doc.*, No. 13, 1st Sess., 74th Cong.

[7] *Review of Economic Statistics*, May 1938.

If all prices were as flexible as agricultural prices, the result might well be *less* rather than *greater* stability. The difficulty is that a rapid spread of price reductions creates uncertainty and causes postponement of buying. Some demand curves may for a time disappear altogether. Perfectly flexible prices, in a world where incomes are not always spent, might drive each other down so swiftly as to destroy the whole system. Orthodox price analysis is well adapted to the problem of how productive resources shall *best* be employed, but less well adapted to the problem of whether or not they shall be employed at all. It seems often to have been forgotten that the demand curve is innocent of time and of monetary changes. Aggregate income does not remain fixed, so the question of income elasticity overshadows that of the elasticity of demand.

It is thus quite essential to distinguish two types of price reduction, the secular and the cyclical. The one is non-recurrent, an expression of the changing structure of a dynamic society. This type of price reduction does increase sales for the class of goods we are discussing. Confusion results, however, when this analysis is applied to cycles.[8]

My belief is that commodity price reductions, on the scale which can be reasonably expected were monopolies vigorously and successfully attacked, would not stabilize the cyclical demand for consumers' investment. The reason lies in a combination of the factors I have outlined. But surely the fact that price cuts would not increase sales is no reason why special groups of sellers should have the power to hold their prices up. Price reductions would be beneficial if total effective demand were thereby increased by transferring purchasing power from savings to spendings. They would also be beneficial if they resulted in reorganization and improved efficiency. The stabilization of investment in consumer goods is essentially dependent upon stable income and stable rates of growth. Widespread and rapid price reductions defeat their purpose, at least for a time, by generating deflation and cumulative losses. If all prices were flexible, a deflationary tendency would sometimes be more disastrous than at present. After several months or years of depression, price relationships are often further out of balance than at the beginning of the decline.

If it is depression we are thinking of, I believe that the question "Will a price reduction stimulate sales?" focuses attention on the wrong thing. To be effective, cyclical price reductions need to be localized in order to restore balance without causing cumulative deflationary movements. The effect upon any one business or industry is not

[8] An important aspect of this whole question is the tendency to pursue pricing policies which yield substantial profit at less than capacity operations. In this light there is, of course, a most significant relation between long-term policies and cyclical problems.

the proper test of whether or not price should be reduced. Part of our trouble is that short-term price policy can be determined by men who are looking at their own sales rather than at the whole economy.

To illustrate how price cuts, even for goods with inelastic demand, may be an effective step in restoring prosperity, let us assume an industry in which (a) wages are a small fraction of the total cost, and (b) demand for the product is inelastic. Price reduction in such cases may be quite beneficial in a cyclical sense—not to the industry directly but to the whole system—by leaving income with consumers who spend it and taking from business which does not. It follows from Mr. Keynes' analysis of saving that in those industries where wage costs are a small fraction of total costs, price cuts would be most effective as a recovery measure. The essential reason is that the resulting redistribution is favorable to increased consumption and unfavorable to saving. Workers, of course, are more dependable and more regular in spending habits than is business. It also follows from this analysis that price cuts which redistribute income in a manner that augments savings and retards consumption are unfavorable to recovery.

Those industries where the spread between cost and selling price has been increased most by the depression are, from one point of view, the industries most in need of price adjustment. Steel may be a case in point. If it is recovery we are after, attention should be concentrated, not so much on monopoly as such, but on the "increase in the degree of monopoly power" (i.e., spread between cost and price) brought about by the depression. While monopoly restricts the size of the national income, in itself it is no cause of depression. The system becomes adjusted to monopolies; their elimination would lead to an improvement in organization and a higher level of output of a secular nature, but would remedy depression only, I think, in so far as savings were reduced.

A particular industry may benefit, of course, by price reduction even though it is made at the expense of wages. Building is a case in point. My discussion has been concerned with manufacturing industries. The building industry requires a special chapter. It is, I believe, when price reductions are local, that is, limited to particular industries of strategic importance, such as building or steel, that they are most effective.

It is doubtful if these suggestions have any practical significance at the present time, but it is, I believe, by some such discriminating analysis, rather than by more general theory, that the answer to the cyclical problem can be found. As a stimulant to recovery, price reductions which reach the income groups who do not save are effective whether they directly increase sales or not.

REPLACEMENT DEMAND FOR CONSUMERS' DURABLE GOODS*

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Naturally, in the light of recent experience, our principal national worry these days is instability, and in our search for unsettling influences, we take quick alarm over the fact that in contrast with long-run steadiness, the short-run turns in consumers' durable goods have been markedly erratic. While they accounted for a growing share of the total consumer outlay from 1921 to 1926, it declined sharply from 1926 to 1933 (National Bureau of Economic Research). Like some children, these commodities have been the precious little jewels of our capitalistic economy, but sometimes have behaved abominably.

POSSIBLE SHIFT FROM OBSOLESCENCE TO DEPRECIATION BASIS OF DEMAND

One of the commonly recognized characteristics of consumers' durable goods is that their replacement is postponable. The consumers' choice is not between having a new gas heater or none but between getting a new one or making the old one do. New buying of most such items falls off heavily in periods of deep distress, leaving most of the tiding-over burden to be borne by replacement orders. As normal demand taps progressively lower income levels, this distinction is apt to materialize at a progressively early hour in wintry economic weather. One of the bulging question marks of the future, therefore, is how lightly or anxiously the consumer is going to regard the goods that today are his conveniences.

One of the good tip-offs on the cyclical significance of replacement orders is at the end of the line, in the scrapping records. The average life of a car for example was estimated a decade ago at about 6 years, now at between 7 and 9 years. With the combination of bad times and good cars it has been surely creeping up. At the bottom of the depression it may have been twice what it would have been on a regular course. If scrapping and replacement could be coaxed into some sort of dull regularity, in this and other durable goods lines, the excitement of new purchases might be a little less heady but life itself a little safer.

In the following speculations I want to make it very clear that I am not suggesting what business policy and popular practice ought to be but what under the natural pressure of events they might become.

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There are three kinds of things that can happen to the motives for buying consumers' durable goods that will have a telling effect on the replacement demand for them. The first is saved from being naive only by the reminder that it is not the only one, and is mentioned merely as the starting point in the search for refinements. Old equipment continues to wear out or become obsolete. Without regard to ups and downs in the rate at which that happens, its contribution to replacement demand is bound to be major. It is now a commonplace that the new market for such goods is usually a declining one and the replacement market a rising one. We already know, with respect to passenger cars that at least 60 per cent of the total business was replacement in 1936, although the percentage varies with points of saturation. With respect to most consumers' durable goods it is visibly growing.

Time has already had its way with many of our not-so-long-ago "new contraptions." The sales problem becomes, not how we can persuade Mrs. Susie Jones to enter the happy family of "Ever-Wear" percolator users; but "how can we persuade her to get rid of last year's antique."

I have succeeded in tearing from the breast of Dr. Lockley of the Curtis Publishing Company some unpublished and still tentative estimates of the extent of our present dependence on replacement rather than new markets in a number of well established lines. They are as follows:

From 20 to 25 per cent of mechnical refrigerator sales are for replacement.

Ninety per cent of residences may be replacement, although I am not leaning very heavily on that surmise because of the difficulty of defining a replacement dwelling. (With respect to this figure it is any new house moved into by a family that has been living somewhere else.)

The radio replacement market is now pretty well up to 80 or 90 per cent of the total, as is the case with electric irons. According to the survey, 90 per cent of our wired houses are now equipped with electric irons, many of which work. A similar degree of practical saturation obtains for radio.

About 80 to 90 per cent of the gas and electric cooking stove business is replacement.

Washing machines and vacuum cleaners, 70 to 80 per cent.

Food mixers—virtually none of this business is replacement, for the interesting reason that 30 to 40 per cent of them are rarely used despite gleeful anticipations at the time of purchase. Neither are there many replacement orders so far for electric percolators, according to the

Lockley survey, as barely half of them are being used. Housewives gave a variety of reasons for this neglect but most of them were complicated ways of saying she didn't like to clean it.

Despite occasional eccentricities it seems fairly clear that our ability to finance convention trips is coming to depend more and more either on the exhaustion of goods through use or on business ability to get people to throw things away instead of learning to like them.

The first point belongs to the death and taxes category. The goods will wear out if we give them a chance. The second and practical problem with which prophets are confronted involves the rate at which replacement will actually occur. We therefore set out in search of determinants of speed, and at least two put in a reasonably well defined appearance. The first is the reaction of the market to continuing technological improvement and the second is the future of style as a selling force. A less sonorous way of putting the question is (a) can the consumer be coaxed into trading in his mechanically satisfactory year-old car to have his gears shifted by wind instead of by hand and (b) ditto for the sake of sitting on air-filled sponge rubber and gazing at a "Ferdinand the Bull" radiator cap. Naturally reference to these windy improvements is accidental and is not to be confused with selling technique. The distinction is merely between technology and style.

(a) The aspect of consumers' durable goods that has been heralded in song and story, almost to the point of blinding us as a people to our social and economic defects, is the incessant improvement in efficiency and appearance of our consumers' durable goods. Many book shelves can be packed without crowding into the observation that our technological accomplishments have been phenomenal. They have helped to make us what we are, to turn over a substantial fraction of our national productive facilities to durable goods, to make both our standards of social values and our economic stability itself dependent on them in a considerable part, and therefore to create the problem which is the subject of this paper. Now the very natural and painful question arises as to how well the established tempos of replacement speed can be maintained or advanced.

Impression number one is that we can hardly continue to expand at the rate we have in the past, i.e., *in the commodities already developed.* Year after year the manufacturers of consumers' durable goods have succeeded in fascinating the public with new engineering miracles and have thereby kept the national purse strings loose to the fairly complete satisfaction of everyone concerned. And it is quite true that the imagination of our scientists has as yet showed no signs of exhaustion. Yet the statement that the law of diminishing returns is likely to

slow down the rate of acceleration in efficiency and in sales has a mathematical basis at least. Assuming that in some past year or other the cost of driving an automobile dropped from 20 cents to 10 cents and later from 10 cents to 6 cents, and eventually will drop to 2 cents, there is definitely more room for improvement behind than ahead. The actual differences in costs in successive years is naturally less than it used to be, and the replacement appeal to the public must be less in some unequal degree. Far though we may be from infinity in this process, the area of possible growth becomes annually more limited.

Naturally it takes a brave soul to name the year whose improvements cannot be called epochal by our advertising friends. Engines can go to the rear, speeds increased, more delicate controls devised, Diesel engines substituted, alcohol come into its own as fuel, and the cost of operations driven down to a half-cent. The most serious limitation indeed may be in the national acreage over which we may drive, but even this difficulty merely conjures up a vision of hexagonal highways with parallel lanes on, above, and beneath the earth. Buck Rogers may err in the particular instruments of science he has brought to us from the stars, but he may not be so far off in the appearance that they will create.

Any radio technician is likely to turn on you with amazement at the suggestion that the age of practical growth is nearing its close. Presumably the radio speaker marked one of the evolutionary turns in that industry. For a long time thereafter the emphasis was on tone. The problem still remains of obliterating static. Some time in the future, once all cosmic secrets are torn from their hiding places, we may expect to listen to the music of the spheres. Already we are resigned to television.

These pseudo-scientific images are worthless for exact purposes, but they do illustrate the difficulty of deciding in what decade and at what point technological development will cease to thrill the public to the point of inducing an unnaturally rapid turnover in its durable goods. It is important to remember in connection with any such speculation that it has been presented in terms of degrees, and that it is entirely possible for a new *quality* to be as captivating as a long percentage jump in mere efficiency. A successful re-designing with engines in the rear, might conceivably bring about a wholesale revision in the public attitude toward driving, and permit the industry to start again from somewhere near scratch. Even the geometrical progression of diminishing costs can backfire on us if performance is made the measure instead of costs. While it is correct to say that the cost of a tire can never be reduced as far as it has already been reduced, it might

still be built to last six years instead of two, which once again turns us in the direction of infinity instead of zero. But even this reversal makes for slower and not more rapid replacement, so that the two forms of improvement between them develop a nut-cracker rather than a lifting action. One may look forward with reasonable confidence to the partial shifting of consumers' durable goods replacement from an obsolescence to a depreciation basis.

Perhaps it should be again emphasized that this piteous little picture of failing powers in technology has no reference to scientific progress per se. It is doubtful if anything will stay that progress in any period of time we're interested in. It is simply a guess that market interest in an improved miracle can never be as excited or effective as in the miracle itself after it has been reasonably well domesticated. Nor does it mean that industry will ever be induced to antiquate its goods to the level of low income markets. I gathered the impression in our session on the automobile industry that manufacturers should back up far enough toward the pre-war Model T's for economists always to have fresh cars available at $290.00 apiece—the cost today of producing them. But the hedonistic measure is apparently accepted by the buying public, however unbending may be the official price curves.

As already inferred, compensating weights will doubtless be found in the development of still new durable goods which will pass through the same evolutionary stages from scepticism to general acceptance. At an earlier day the first stage would probably have been ridicule, but the world has learned to be too respectful of science to fall into that error any longer. Its credulity is perhaps now as marked as once was its disbelief.

(b) The second determinant is an even more uncertain quality. What evolution will occur in the "keeping up with the Jones" fashion in American social life? It might conceivably cut both ways—further emphasis on style by the manufacturers, and a revolt against the extravagances of style on the part of the public.

The instinctive thought is that manufacturers will try to make up by style intoxication what they lose in diminishing returns on technology. If it should be true that technical obsolescence, one of the major sustaining forces of replacement up to the present time, will have to give way eventually to a depreciation basis of purchasing, a new emphasis on style and gadgets may be the remedy to which manufacturers will turn.

And oddly enough it is not impossible to imagine that the turn will be in the other direction—that a point of relative apathy might also be reached on style and gadgets, offset in part by the firming of con-

sumer standards with reference to appearance and performance of old equipment. Style played down and respectability played up. The latter may be so improbable as to be merely a light fancy, but the treatment of it will be brief. A playing down of style would work against high-speed replacement and artificially stimulated volume, and a playing up of respectability on the part of consumers would work against last-gasp operation and toward more regular replacement. Market interest would be responding more comparably to the eccentricities of men's clothing than of women's hats, whereas at the moment the center of fascination probably lies a little on the side of the hats.

I haven't the slightest idea as to whether this will actually happen, but it is not chimerical. Goods that become entrenched in the economy can settle as to merchandising tactics as well. In 1845 bathtubs were considered slightly indecent. One of the largest cities passed a law against them. All of this is of course a study in degrees. Replacement of bathtubs will still be postponed in bad times, but like the baths themselves won't be postponed as long as was once the case.

Whenever we deal with goods that are perched far above the level of biological necessities, we come close to dealing with states of mind, so that we are entitled to regard them as an unceasing influence and to speculate on where they will come to rest. Style is much more a matter of emotion than of good sense, which makes it very important. No matter how softly you say it, consumer durable goods are a source of instability. To the extent that they are popularized by decoration and other ephemeral appeals some argue that their quality of instability is heightened. Conversely, as they lose this function of being the flag of prestige and become commonplace utilities, their capacity for whip-cracking the cycles may decline.

Even should there be a deemphasis of style, its extent could be sharply limited by its restriction to new merchandise. The buyer of second-hand merchandise is even now not buying style. But as long as we are merely speculating, we may as well imagine that any lift in customary appearance and performance standards will be general, without stretching the equally customary spreads between income markets. That would mean that whereas the new car buyer would not run it after the paint faded or repairs become necessary, the third-hand buyer would consider it undignified to run it with more than one fender off or two cylinders missing. We would leave that to the fourth-hand buyer, who might emerge as a new economic class in this future day—provided that the scrapping level itself were not raised and the jaloppy put to rest with the dinosaurs.

Most consumers' durable goods are lodged at a disdainful eminence

above the agricultural and industrial societies symbolized by yams and church bells. They have pulled up the center of gravity of our economic system, and rendered it more likely to sway in adverse winds. To the extent that consumers' durable goods may achieve a place in popular ideology that is plain and matter-of-fact, with growth corresponding to economy and service even on a diminishing scale, more closely than to fashion, is the pressure of buying incentives more likely to be steady.

FURTHER DEVELOPMENT OF SERVICES

An interesting feature of the mechanical department of the consumers' durable goods business is that as replacement falters service requirements increase. An old car or refrigerator, or radio, or washing machine, requires more repairs than a new one, and more men to make them. Naturally the inversion is not exact, for people in the low income bracket will also put off all but the most necessitous repairs. Nevertheless, the main thesis is certainly borne out by the flexibility noticeable in the scrapping of automobiles. Only about half a million were discarded in low year of 1933, when drivers of all classes hung on to their steering wheels even though their cars might be dissolving under them, whereas in 1929 and even in 1931 nearly 3,000,000 vehicles were nonchalantly laid aside. Car registrations in the depression declined very little, and gasoline consumption negligently. Gas tanks and steering wheels at least have proven their right to the title of durable goods. A heterogeneous new industry has grown up to keep radios going, and even ice-boxes have their feudal following among the mechanics. In terms of economic effects we have the paradox of instability in one branch of industry setting up at least a cushion against potential instability in others.

REPLACEMENT DEMAND AND CREDIT POLICIES

Existing sales of consumers' durable goods have come to be what they are partly as a result of the creation of new dimensions of credit. Policies respecting it can advance or postpone the date of replacement. If there should be strict adherence to approved principles such as 33 per cent down payment on automobiles or 10 per cent on refrigerators, contract periods of one year or less, elimination of poor risks, limitation of security to merchandise alone, etc., marginal volume would be expected to decline. On the other hand, a more liberal policy with respect to payment of interest on unpaid balances might be stimulating to the extent that it was understood and appreciated. The decisions would presumably be made in the name of commercial policy; the most important effects might be economic. For marginal business is doubt-

less a big weight on the cyclical pendulum in both directions. The exercise of caution could be one of those influences making for greater stability, although in this case at the cost of reduced volume.

The plainest fact at any rate is that consumers' durable goods are now financed on a huge scale, and an inevitable assumption is that some important part of their market success is to be attributed to the lavishness with which credit has been extended. In 1935, as much as 59.9 per cent of total automobile sales was on an installment basis; 54.9 per cent of household appliances and radios; 48.7 per cent of furniture. This form of financing has long been regarded by economists as one of the neighbor's children. It can be sweet as honey and bad as punch. It raises sales of what ordinarily might be ponderous merchandise to a mass production pitch, but in the country's weak moments that pitch can be precarious. For automobiles, the record was 63 per cent on installment credit in 1929 and 49.7 per cent in 1932. The fact that finance companies themselves agreed on the necessity for retrenchment during the last boomlet is evidence of the subjective nature of this particular element in cyclical swings. Business policy is very much of an emotional phenomenon, and it oscillates in the grip of mass psychology much as do styles, investing and rubbernecking, which after all are merely different moods of the same human beings. When a few million tons of consumers' durable goods oscillate with it, it is not surprising that our business cycles have taken on a touch of the majestic.

The climactic criticism is sometimes made of these financing methods that the goods so covered must be paid for out of income rather than from new production made possible by the loans themselves. Here is a private precedent for the administration's reputed fascination with statement "budgets," under which any material form into which the government's money might go would be set up as an asset on the balance sheet and thus comfortably dispose of operating deficits.

No matter how we look at it there always seems to be two factors at work. To the extent that our business rhythm is at the mercy of postponable goods, stability is vulnerable. To the extent that the livelihood of individual consumers is made more secure through advancing income, instability when it occurs should do less damage. Both elements expand importantly with rising general standards of living, but any endeavor to appraise their relative weights over the long pull goes beyond even speculation and into the spheres.

THE FINANCIAL ASPECTS OF RAILROAD CONSOLIDATION*

By Shelby Cullom Davis, *Treasurer and Economist Delaware Fund, Inc.*

The financial situation of the railroads obviously is in need of improvement. Not only would an improvement benefit railroad bondholders and indirectly the 44 million savings' bank depositors and 64 million holders of insurance policies, whose interest in the railroads has become marginal and hence should be vital, but it would also stimulate the general economy, for the railroads in their financial heydey were enormous purchasers of capital goods. In fact, the railroads have been called America's 20 per cent industry because their purchases in normal times approximate 20 per cent of the nation's output of coal, iron and steel, timber and fuel oil.

Granted that an improvement is desirable, the question remains: "At whose expense should this financial improvement take place?" Labor has said "no" and has been upheld by the recent President's Board. The shippers protest, usually quite effectively, against remedial rate increases and there are nearly 500,000 corporations compared with 139 Class I railroads. The communities and politicians are notoriously tax-conscious. And capital, that is the bond and stockholders, seems reluctant either to give up old claims or to scale them down. Proof of this would seem to lie in the fact that no major railroad reorganization has yet been completed after almost 9 years of receiverships.

Consequently the question of consolidation, which does not appear at first glance to tread on anyone's toes, is again being actively discussed.

Will consolidations help the financial situation of the railroads? That, in my judgment, depends very largely on the nature of the consolidations which in turn depends on the basic theories under which Congress may propose that these consolidations be made. Question 1, and probably foremost: Should it be consolidations with or without benefit of competition? The Transportation Act of 1920 which directed that the Interstate Commerce Commission propose consolidation plans for all the railroads insisted that competition be maintained. Question 2: Should consolidation be carried out only on a nation-wide scale, as the Transportation Act of 1920 directed, or should it be carried out piecemeal? Question 3: Should the initiative come from the railroads themselves or from the Government and, a corollary to this—should

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it be compulsory or voluntary? Question 4: Should the consolidations be carried forth in strictly maintaining existing routes and channels of trade, as directed in 1920, or is a complete revamping of the railroad map desirable? Question 5: Should the consolidations endeavor to equalize the cost of transportation as among competitive systems and thus set up a number of giants of relatively equal stature, as say in the tobacco or petroleum industries, or is this theory of equal competition too impractical today?

Nor do these questions complete the list of queries which a proponent of railroad financial salvation through consolidation should ask himself. And yet upon the answer to these questions depends the nature of the consolidations and hence the financial savings that might be effected. For example, if competition is to be maintained then the consolidations are apt to be more on the end-on or trunk line system rather than the regional system basis. For if financial savings are to be realized by the elimination of competition which is certainly possible but which competition, nevertheless, is desired by labor, shippers, and the various taxing units, then the dominant railroad in a region would absorb its competitors.

Perhaps it is best to accept as a basis for discussion those principles agreed upon recently by the President's Committee composed of six leading railroad executives and railroad union leaders and appointed to submit recommendations upon the general transportation situation. The Committee agreed that consolidations were desirable but thought that these should be worked out piecemeal by the individual railroads themselves, subject, of course, to Interstate Commerce Commission approval, and should be entirely on a voluntary basis. These recommendations in many respects run counter to the Transportation Act of 1920 as well as to the views of some of the present members of the Interstate Commerce Commission, such as Commissioner Eastman. He believes that consolidations must be worked out by government and probably must be compulsory if they are to be effective at all. In fact, Commissioner Eastman would change present consolidation requirements in a number of ways. He would not, for example, require adherence to a general scheme of consolidation prepared by the Interstate Commerce Commission. And as to the financial aspect he would make stock-purchasing campaigns unnecessary for any carrier desiring consolidation by conferring on it the power of eminent domain, subject to Interstate Commerce Commission approval. And to facilitate consolidations he would cause dissenting stockholders to be paid off either in securities or cash so that they could not obstruct a two-third's majority.

The President's Committee also thought that consolidations should be effected preferably through exchange of securities which should result in reduction of fixed charges. This was not obligatory, however. In order to reduce fixed charges it specifically forbade any consolidation effected through a leasing arrangement which guaranteed dividends, as so many of the consolidations of our railroads in the past have done. And by the term "consolidation" was meant actual unification of two or more railroads whether by technical consolidation, merger, purchase, lease or common control.

One of the major purposes of the Transportation Act of 1920 was to aid directly the short and weak lines by their inclusion in strong systems. The President's Committee reverses this stand and advocates inclusion of the weak with the strong railroads only if a consolidation plan which did not include the weak railroads would isolate and injure them still further. In other words, the weak railroads now have to show cause—although a really comprehensive nation-wide consolidation scheme which did not include certain weak railroads would most probably tend both to isolate and injure them. Although this manner of solving the weak railroad problem may not be as satisfactory to the weak railroads themselves, it can be pointed out on the other side that railroads representing about two-thirds of the country's mileage are in a weak condition and even the non-borderline railroads are relatively weak compared with their former standing. Thus the problem has broadened since 1920. And the President's Committee's reversal of policy will probably tend to aid the consolidation movement by removing from it what the strong lines might term the stigma of charity.

Although the views of the President's Committee are important, they probably reflect more the views of the strong railroads than the weak. In the Lea bill, the omnibus railroad bill now before Congress, it is perhaps significant that the ultimate establishment of a number of strong and efficient systems is looked forward to as a definite objective. But in determining the public interest of a consolidation there were laid down five additional criteria: (1) promotion of efficiency and economy of service; (2) better and cheaper service; (3) simplified and more effective regulation; (4) protection of stockholders and creditors; and (5) maintenance of such competition as is necessary and reasonable in the public interest. Consolidation would still be voluntary but if the Transportation Administrator, to be created, decided that compulsion was necessary he should so recommend to Congress with accompanying appropriate legislation.

In their weakened financial condition the strong railroads lack in-

centive for vast consolidation schemes at the present time. The Pennsylvania Railroad has been weakened by its forays into New England, Southeastern and Middlewestern territory and although it virtually controlled either by itself or through subsidiaries the New York-New Haven and Hartford, the Seaboard Airlines and the Wabash, it allowed them all to go into receivership and incur the danger of loss of control by reorganization. Moreover, it is quite probable that the vast private consolidation schemes of the 20's were made more with a view toward control of traffic than toward lowering costs through consolidation of physical plant and services.

This brings us to an interesting question which is important for the economy as a whole and which, I believe, the economist should consider. Does a consolidation which is desirable only because additional traffic can be controlled really contribute to the financial improvement of the railroads as a whole or does it simply bolster up one system at the expense of another? I suspect that the latter view is the true one. Therefore, if it is the financial improvement of the railroads as a whole that is to be the goal, it may be wise to require that the prospective savings be amply demonstrated before consolidation is permitted. In the demonstration of these savings it is likely that the greatest amount would come from labor, for wages amount to over 45 per cent of railroad gross revenues. From the practical standpoint this would be difficult. Further savings could be demanded of the bondholders through reduction of indebtedness and fixed charges, but is this a contribution to the financial improvement of the railroads or simply an admission of defeat? If scaling down of debt and fixed charges is a positive contribution to the railroad's financial health, then surely the railroads today, with over 33 per cent of their mileage in receivership and awaiting reorganization, are approaching the prime of health and all talk of consolidation is unnecessary.

What other savings are possible through consolidation? As the result of numerous hearings and testimony before the Interstate Commerce Commission, it was the general consensus of opinion that consolidations will result in certain benefits such as longer hauls on the same system, cheaper financing, simplified accounting and reports, more flexibility in routing, avoidance of switching, long full-train hauls, opportunity to purchase on a larger scale, standardization of equipment, lessened number of repair shops, and more cars "at home" on the system. And it seemed to be the opinion of many of the witnesses, although they were perhaps not unbiased, that the financial economies to be achieved through the above methods had been exaggerated; in fact, the Interstate Commerce Commission did not even mention

what savings might be effected when it issued its plan for consolidation of the railroads into 19 systems a little over 9 years ago.

Indeed, Commissioner Eastman then was sceptical of the savings of consolidation and thought sentiment for it emanated largely from financial circles on the lookout for large profits from putting the railroads together. He pointed to unifications in the past which had brought disaster, such as the union of the Frisco & Rock Island. The Chicago & Eastern Illinois, the Kansas Oklahoma & Gulf and the Chicago & Alton among others had all suffered, he said, from previous consolidation experiences.

As the depression of the early Thirties wore on, it seemed to some that a more drastic plan was necessary, a plan formulated principally with a view toward effecting financial savings for all the railroads rather than just the "weak sisters." The so-called Prince Plan proposed in 1933, consolidated the nation's railroads into 7 systems, 2 in the East, 2 in the South and 3 in the West. Its proponents estimated savings on the basis of the depressed 1932 traffic, of no less than $743 million or about 30 per cent of total railroad operating expenses that year. These economies were to be secured principally by the concentration of through traffic over the routes of greatest efficiency and through unification of terminal operations. These economies were studied by a committee headed by William B. Poland, appointed by the Federal Coordinator of Transportation. As a result the savings of $743 million were reduced to $218 million based on 1932 operations or to $321 million based on 1929 operations. Capital expenditures required to initiate the consolidations were estimated at $45 million while capital savings resulting from the abandonment of 11,000 miles of track and ownership reduction of 80,000 freight cars would amount to $66 million. Some students have felt that the estimates of the Poland Committee were too conservative and based upon information supplied by those inclined to be hostile to the idea.

Moreover, it was stipulated in the Committee's estimates that the railroad plant should be maintained so as to handle traffic 20 per cent in excess of 1929 .This naturally raised maintenance costs. As a result these students believe that the savings should be raised to close to $500 million from $218 million. That these are considerable savings can be seen by the fact that total interest on debt of the Class I railroads amounted to $491 million in 1937, while rent for leased roads amounted to $148 million, or a total of $639 million. Should the savings be as low as the $218 million estimated by the Poland Committee on the basis of 1932 traffic, even then this item alone would be over one third of both the interest on debt and rent for leased roads.

In other words, even on the reduced estimate the Prince Plan of consolidation would have gone far towards putting the railroads on their financial feet.

And if the estimates of the Prince Plan of $743 million are correct as those who drew them up maintain that they are, then the financial salvation of the railroads would certainly be at hand. Most of the savings, of course, would come from wages. The Poland Committee estimated that 75,000 men would be effected on its basis of $218 million saved. If $500 million were to be saved around 200,000 men would be effected. This is a substantial number, but even affording pensions of $1,000 annually at a total cost of $200 million, the financial benefit to the railroads still would be $300 million annually. Moreover, the normal employment turnover on the railroads is around 5 per cent annually so that the cost of pensions would be actually less than $200 million and would grow progressively less. Whether the nation believes the perils of bigness overshadow these estimated financial benefits is, of course, another question.

Plans for the financial rehabilitation of the railroads through consolidations are not as numerous as they were a few years ago. Yet some new ones are being considered and through the courtesy of one of the leading financial students of the railroads, who is himself the head of one of our greatest savings institutions, I am able to reveal one of the plans which is being discussed privately at the present time. The theory of the plan is based frankly on the premise that the trend of government throughout the world is to exercise increasing control over private enterprise. To meet this changing condition it is deemed only realistic for the railroads to abandon many of their past traditions. The proposed plan would set up a National Railroad Administration with the authority to issue securities in voluntary exchange for present existing railroad securities. But instead of the railroads exchanging their securities with each other, the securities would be exchanged for stock of the National Railroad Administration which would be, in effect, government stock. This new stock would carry either guarantees of interest, priority liens on income or an equity in assets which may develop earning power—all depending upon the exchange value of the old securities. Needless to say, the determination of this exchange value would be an important task. It would be the work of a Federal Court of Appraisal on Railroad Values which would be set up. Criteria such as the following would be used in computing a fair valuation for existing securities: the commercial bond and stock ratings, interest and dividend records over test periods, market quotations over a period of years, and the valuation of individual railroad properties as

established by the Interstate Commerce Commission. There would be no compulsion in this plan. But it is thought by those sponsoring it that the present owners of the railroads would see the attractiveness of exchanging their present claim for government obligations, particularly if the value of these claims in the past was given considerable weight. Total savings in interest and operations have been calculated at $500 million to $750 million annually.

Undoubtedly some such plan has its appeal to some railroad investors. And yet there are others who take a less pessimistic view of the financial outlook of the railroads. It is true, they argue, that with the same level of industrial production prevailing in 1936 as in 1926, that passenger revenues declined 60 per cent and revenues from freight 31 per cent. This is apparently a telling illustration of the secular decline of this great industry. And yet it is equally true that capital goods activity in 1936 averaged no less than 25 per cent under that of 1926 and it is in the field of capital goods that the railroads have best maintained their competitive position. Should a high level of building activity be sustained through the easy credit conditions of the Federal Government, should the spending policies of Chairman Eccles of the Board of Governors of the Federal Reserve System be followed so that huge deficit spending would be maintained until full employment is reached, and should private capital at last be enlisted for the recovery, then talk may yet be heard of the rejuvenation of the American railroads, and without consolidation. Certainly this is the most painless solution to the railroads' financial problem that has been proposed, although parts of it may eventually be painful to the whole economy.

Those who urge that financial salvation of the railroads lies through consolidation usually point to the drastic process of amalgamation in Great Britain just after the World War when about 120 separate railroad enterprises were reduced to 4. Yet it can also be pointed out that the area of Great Britain is less than 3 per cent of that of the United States, that there are 12 miles of railroads here for every 1 mile in Great Britain and that in Great Britain the absence of constitutional restrictions has enabled the problem to be dealt with more directly than here. Furthermore, the financial salvation of the British railroads may be entirely too optimistic a characterization. As the building boom in Great Britain has subsided and as highway construction and automobile production have increased, the revenues of the railroads have declined and, as a result, at the present time the British railroads are undergoing their greatest crisis since consolidation.

One of the foremost exponents of railroad consolidation among railroad executives has been Ralph Budd, President of the Chicago, Bur-

lington & Quincy Railroad, itself a consolidation of over 200 companies. Incidentally the C. B. & Q. makes use of the property of other railroads in no less than 489 instances while other railroads make use of C. B. & Q. property in 492 instances. Mr. Budd believes that reducing the number of railroads to about 20 would eliminate a tremendous amount of overhead organization, would enable the traffic to be concentrated on the most favorable routes, using the best parts of the several lines as they now exist, and would automatically bring about the most desirable type of coordination of terminals, namely coordination under a few strong ownerships. On this last point Mr. Budd can speak with real feeling as any one who has shuttled among the almost score of terminals in Chicago realizes. He can also see the need for consolidation more than other railroad executives, perhaps, since the C. B. & Q.'s territory is bitterly competitive not only among competing railroads but with the trucks.

The amount of possible savings through consolidation naturally depends on the consolidation plans but unless public opinion crystallizes on this issue it seems more likely that the consolidations will come through the efforts of individual roads rather than according to a grandiose plan. The bondholders of the Mobile & Ohio and Gulf Mobile & Northern have recently acted courageously and literally fought their way through to a merger despite the opposition of management. If a few more consolidation yardsticks, an unpopular term just now, can be set up and proven, then that great silent body of railroad bondholders and stockholders may be at last galvanized into action. For it is they who have the real financial incentive for consolidations, not labor, not management, not the shippers, not the tax-conscious communities.

And yet the public at large, the savings bank depositors, and insurance policy holders have a financial incentive in railroad solvency too. It is not that railroad bankruptcies may lead to the insolvency of savings banks or insurance companies, for fortunately not enough of their assets are in railroad securities to bring this about. But because of the reserves which the savings banks and insurance companies have had to set up out of earnings to care for the depreciation of their railroad portfolios, the interest rate on savings bank deposits will tend to be lower and the premium rate charged for insurance will tend to be higher. Someone must take the ultimate loss and that someone is often apt to be the general public. When this is commonly recognized and the financial incentive broadens, then I believe more and effective talk will be heard of railroad consolidation, for, in the end, will it not be the financial aspect which will determine the issue of railroad consolidation?

NOTES ON THE INTERPRETATION OF EXTERNAL STATISTICS*

By Q. Forrest Walker
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Statistics have become indispensable tools of modern business. We may use the term "internal statistics" to describe the data of the individual enterprise, and the term "external statistics" to refer to the wide range of other data that are related directly and indirectly to the problems of the individual business. Current trade and general business statistics fall in the external grouping. They are the subject of our discussion here this afternoon.

Never before has the statistician had available such a mass of data for the formation of reasoned conjectures as to the ebb and flow of economic activity. Our external statistics have shown a marked increase in quantity and improvement in quality during the past ten years. Government and private agencies pour out an unending stream of raw and refined data. Newspapers, trade magazines, and business services have popularized the use of all sorts of measures of our economic health. Statistics are now standard equipment of the politician, the social reformer, and the ordinary business man. They are weapons of economic offense and defense. They are at once a social asset and a social liability.

Their universal use places upon the professional statistician and the economist a new responsibility. If statistical facts are improperly used and erroneously interpreted, they can cause serious economic havoc. When errors are widely disseminated in the press and over the radio, the process of correction is more difficult than the removal of the stigma of unjust slander. We cannot, of course, prevent the misuse of statistics by quacks in the profession, nor can we prevent the unskilled from placing erroneous interpretations on social and economic facts. But we can do much more than we are now doing to stress the limitations of statistical method and interpretation. We are confronted with a situation that is growing more and more serious. One wonders if the time is not near at hand when this Association will be compelled to take some positive action to safeguard the interests of the profession. It is for this reason that some remarks on current abuses in the uses of statistics may be in order. The abuses arise out of both method and interpretation. In external statistics, method should seldom be an end

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in itself; the pragmatic test is always the accuracy and usefulness of the result.

During the past several years a number of composite indices of general business activity have appeared. They stem from the early efforts of forecasting services to provide over-all measures of economic activity. The advance in statistical techniques has been reflected in the construction and general improvement in these measures, but the trained statistician knows that they can never be more than rough approximations to the economic truth. The number and scope of the component series, the selection of base periods, the weighting and other corrections of the raw data involve a number of assumptions that give final index numbers a substantial degree of artificiality.

Unskilled persons often assume that these indices are as reliable as a clinical thermometer. The agencies that publish them seldom warn their subscribers about the danger of drawing conclusions from minor changes. The skilled physician is very careful in appraising the significance of a minor change in the temperature of his patient and he relates the temperature reading to all other relevant facts about the patient and his affliction; but in interpreting business conditions we lean too much on imperfect measures of economic temperatures.

One widely publicized index of industrial production has acquired a prominence somewhat disproportionate to its economic significance. The business world awaits its monthly announcement with an interest comparable to decision days in the Supreme Court when verdicts on vital constitutional issues are pending. It is repeatedly cited in discussions of our economic ills and it forms the basis for much official and private opinion on our economic condition. But this index is only a partial measure of production and is based on a restricted number of series. It is not safe to assume that its minor moves truly reflect the current flow of all production activity. Another index with a broader base shows smaller amplitudes in fluctuations. However accurate these measures may be as indications of long-term flow, we must recognize their limitations in short-term appraisals.

It is easy to forget about the magnitudes of probable errors. It is not at all unusual to find instances in newspaper business pages and trade magazines where changes much smaller than the probable error are head-lined as bullish or bearish news. Recently, a highly reputable financial paper featured a change in its seasonally corrected index of car loadings from 78.1 to 78.2.

Also a widely read metropolitan newspaper had a prominent headline to the effect that department store sales for the month were only

6 per cent less than a year ago whereas, if proper allowance had been made for difference in the number of business days, the figure would actually have been about 11 per cent less.

A well-known weekly index of production based on seven series was high-lighted with scare headlines when it declined from 93.1 to 92.7 in the last week of November.

Minor changes in general price indices and many other series are also exaggerated. The change in the raw facts may be news; but it is extremely doubtful if weekly moves in corrected indices have much value. It is a fair conclusion that they tend to contribute to the instability of business judgment. There is a genuine need for much more careful editing of statistical comment at its source.

The correction of statistical series for seasonal variation is also applied in some cases where such technique is not really warranted. There are plenty of difficulties in making adjustments for seasonal shifts in monthly data, but when this correction is applied to weekly data the results are often little short of fantastic. The query may well be raised as to whether experiments of this type should not be eliminated from all published material. Probably, the use of cumulative data for comparable time periods furnishes a better measure of trend. Such comparisons of cumulative data show not only the situation this year to date in relation to last year, but also changes in current position from week to week. On the whole, it is a safer method than a seasonally corrected weekly index.

Part of the statistical crime wave may be attributed to reckless use of averages and percentages. The trained statistician is, of course, quite familiar with this danger, but unfortunately he has had only limited success in bringing his influence to bear upon dabblers in social arithmetic and lay interpreters of current business statistics. These persons seem to assume that because the accuracy of the calculation may not be questioned, its meaning is equally unassailable.

The average man is often a figment of statistical and political imagination. He may live in urban areas with an average income of x dollars; and in rural areas his average income may be y dollars. It is then concluded that the difference in dollar income or $x-y$ is the measure of relative economic condition. Or an industry may operate at 20 per cent of capacity one week and at 25 per cent the next week, the 5 per cent difference in operations being translated into a 25 per cent gain. Similarly, an index number may rise from 60 to 70 and the ten-point gain becomes a 16⅔ per cent increase. The computation of percentage change from an abnormally low base exaggerates the significance of improve-

ment or impairment of economic condition. Again, the average cost of performing retail operations is x per cent of sales and any retail price that does not yield x per cent is deemed a predatory price. The social and economic damage caused by uninformed and by overt perverted uses of averages and percentages is appalling. The science of numbers is threatened by the incantations of the economic medicine man.

Another group of errors arises out of the absence of corresponding monetary and physical series. Probably, we shall never have national measures that can be properly related. We have no national index for the flow of all goods and services. The current compilations of national income on a monthly basis represent an approximation of monetary flow, but they are quite inadequate as measures of monthly changes in the real economic status of our people. The symbols of economic wealth are never so important as the wealth itself. The changes in the actual flow of goods and services are undoubtedly far less marked than the rise and fall of their symbolical equivalents. It should be noted that no method has been developed for computing the impact of purely monetary factors upon national income. These considerations not only indicate the futility of monetary approaches to the problems of depressions, but also the danger of drawing too positive conclusions as to our economic health from monthly figures of national income. And this is quite apart from other questions such as the question of the completeness of coverage and the methods used for estimating some of the component parts of the total figure.

It was Pareto who repeatedly warned us of the "error in mistaking relationships of interdependence for relationships of cause and effect."[1] In a recent editorial,[2] the *New York Times* does not mince words in condemning a tendency to view inadequate national income as the cause of the low rate of industrial activity. The failure to observe the principle that Pareto so strongly emphasized is undoubtedly responsible for many mistaken interpretations of economic statistics.

For some individual industries we have both physical and monetary series, but for many others only one type of series is available. Dollar figures alone tend to give us distorted notions of physical flow and physical facts alone may lead us astray in appraising the monetary significance of the situation. Frequently, we have no adequate means for correcting series of either type to throw light on our problem. It

[1] Pareto, V.: *Mind and Society*, Vol. IV, p. 1688 (English translation, Harcourt, Brace & Co., Inc., New York, 1935).

[2] *New York Times*, December 3, 1938.

would seem that more research in evaluating economic activity in particular industries in both monetary and physical terms and relating the two series could produce fruitful results.

For instance, there is always considerable concern when mounting expenditures for new residential construction are accompanied by rapid shrinkage of square footage. Rising or falling retail sales may occur with increasing or decreasing transactions or tonnage. Similarly, in other industries, the trend of both physical output and corresponding dollar sales may be necessary in appraising future conditions. When one surveys the bullish and bearish interpretations of trade statistics that are caused by one-sided analysis, the need for both types of series becomes apparent. We have no adequate means for converting national income figures into true measures of the flow of production; and similarly there seems to be no satisfactory short cut from the indices of national production to national income. But for single industries analysis of monetary and physical series may often produce results of high value as an indication of future trends.

It may be helpful to set forth another positive suggestion on the interpretation of trade statistics. It is doubtful if one can hope to draw the most useful conclusions as to future trends solely by compiling, plotting, and fitting trend lines.

Statisticians with limited business experience frequently underestimate the value of the opinions of business men on economic trends in their trades. Business men wholly untutored in statistical methods and with scant knowledge of the basic statistics of their respective industries often display uncanny accuracy of judgment about trends in the fields with which they are associated. Constant observation and experience in a given trade tend to develop a "feel" of economic conditions. It seems probable that these persons have poured into their respective streams of consciousness a strange mixture of fact, opinion, impression, and perhaps prejudice. These notions seem to be stored up in a mental reservoir. When you ask these men for opinions on conditions in their lines, they are often unable to advance very logical explanations of why the outlook is good or bad, or they may even give you trivial reasons, but the net conclusion may often be unusually sound. The so-called "hunch" of the business man may sometimes really be a profound judgment arising out of subconscious appraisal.

The essential point that deserves emphasis is that one cannot draw the most useful conclusions as to the meaning of business statistics solely by isolated analysis of data. Continuing contact with executives directing enterprise, or their associates, is always helpful. The skilled

business analyst will find it profitable to do voluminous reading of trade and newspaper comments on business conditions. It may often seem that this work is wasted effort, but it is the only way to get that mysterious "feel of the market place" when one cannot engage directly in a particular trade or lacks the contacts from which he may get opinion. Frequently, the trade comments are more important for what they do not say than for what they do say. The most successful trade analysts are invariably those persons with sound statistical and economic training who have cultivated the ability to soak up a mass of gossip and comment and to superimpose it upon their factual knowledge. Some of the best guesses of trade trends may have their origin in the trifling trade comment that opens up a new view of the problem.

In conclusion, the opinion may be ventured that successful interpretation of external statistics is likely to continue to be something of an art despite all the progress we may make in improving our techniques.

COLLECTION AND INTERPRETATION OF INVENTORY DATA*

By Walter Mitchell, Jr.
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Various trade associations, governmental and private research agencies have recently been gathering increasing quantities of inventory figures. These facts were supposedly needed as part of the background for study of specific problems; not because of a prying impulse to look over the fence into the other fellow's back yard. The accepted ideas of what is wanted, and why, are to be gleaned from spoken and published comments, by and about users of the figures. There are three major types:

a. Business men—buyers and sellers interested in market trends of the specific goods which they handle.
b. Business observers and forecasters—who cherish the hope that by watching inventory figures, they will be better able to predict the course of prices, sales, and profits.
c. Legislators and other brooders upon government policy—who still believe we can set up counter-waves of sufficient force and with the proper timing to calm the damaging surf of our business cycles.

All three groups of users have one expressed wish in common; they would like the inventory picture yesterday at the close of business. But they differ as to the kind of lens which should be used in the camera. The business man wants to know how inventories are in his own trade, while at the other extreme, government experts and general economic observers want the broad panorama even if some of the detail is slightly blurred. Between these extremes is the observer or investor in a specific industry, who may want either type of information, depending on the character of his interest.

How can we make a *true* showing of trends soon enough after the facts to meet the requirements of these various users? The sad part of a statistician's life is that the average user of such data seldom gives a thought to this central problem which causes the statistician to lose his hair or turn gray, depending on whether he believes in retreat or camouflage.

Upon one underlying concept everyone is fairly well agreed—that inventory figures alone would be of little value. An inventory which

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might appear ridiculously high and a cause for panic at one sales level may not be adequate, even with the most careful control, to take care of requirements when sales are moving more briskly. The obvious and normal comparative of stocks is sales, the size of the pond versus the stream it feeds. But in any period of improving business the question arises as to how much we can safely raise the level of the pond in order to increase the rate of flow in the stream. The capacity to hold inventory is closely tied to the amount of working capital. Thus the percentage of working capital represented by inventory is also becoming recognized as a significant ratio both for individual concerns and for an industry as a whole.

Discussion logically starts with the problem of gathering inventory figures in specific industries or trades. Except in those well-knit industries dominated by a few large corporations and served by a strong trade association, this is a matter of sampling. Because of expense, questionnaires must be sent out by mail; and the returns from such a mailing are almost certain to be biased. Small concerns commonly lack the necessary records to report accurate and prompt figures. The less successful members of the industry may hesitate to report their experiences. This latter bias cannot be measured or compensated quantitatively; at best it can only be allowed for in the interpretation of results. The former bias, usually the result of excess reports from large organizations, can be taken care of by figuring trends for specific size groups of concerns and giving each size group its proper weight as computed from Census or Treasury Income statistics. The sample of small business is always relatively small and its weight must be enlarged.

A striking example of the necessity for preventing the big boys from stealing the show came to my attention in connection with the Midyear Inventory Survey, made last July by Dun & Bradstreet. In that case, the return was as good as anyone could ask for—about 80 per cent of the questionnaires mailed out were filled in and returned—the majority of them within three weeks from the date of our original mailing. However, this excellent return by no means solved our problem. The mailing list consisted of those concerns who had voluntarily cooperated on the previous Business Trend Survey conducted in January, 1938, therefore, involved the size bias discussed above. On this account the Survey estimates arrived at industry and trade totals by the method described above and at national totals by using industry weights derived from the Census.

This procedure was particularly essential in the field of manufacturing where the reports covered more than 80 per cent of the output in

such large industries as automobiles, petroleum refining, and meat packing but ranged down to a 2 or 3 per cent coverage in about half a dozen of the 40 industries tabulated.

Our estimates compiled in that manner showed that manufacturers' inventories had declined by 8 per cent during the first half of 1938, whereas two earlier estimates from other sources had placed the decrease at 17 and 21 per cent, respectively. These differences were matters of sampling. The big apples were on top of the bushel and in the necessary haste of developing prompt business figures, it was assumed that the well-known little apples underneath were of the same kind and color.

The Dun & Bradstreet Survey was based on reports from over 5,000 manufacturers with inventories aggregating $2,700,000,000 at the close of June. One of the other estimates was based on the reports of 50 corporations with $220,000,000 of inventory, the other on 66 corporations with a $582,000,000 aggregate. The trends in both cases had been computed from the aggregates of the reported inventory figures.

However, the discrepancy was not entirely a matter of size. Segregating the Dun & Bradstreet reports from corporations with sales of over $10,000,000 and weighting them according to their importance of the several industries, we found that the inventories of large corporations had declined 11 per cent in the six months period under study—a figure considerably higher than our integrated estimate—but still a long way below other estimates.

A stew pot containing the published inventory figures of large corporations might not always give forth alluring and misleading odors, but it did so in this case. The straight totals happened to give excessive weight to automobile and automobile accessories manufacturing, simply because more published reports were available at that time in those industries. These in turn, happened to be the two industries which showed the greatest reduction of inventories during that period —38 and 28 per cent respectively. Adjustment of the other estimates to cut down the excess weight of these two industries brought them about in line with the 11 per cent inventory decrease which our figures showed to be characteristic of large corporations.

The small fry among wholesalers and retailers are even more difficult to catch with the wide mesh of a questionnaire net, yet the multitude of decisions made by these small business men affects the business outlook. Their relative importance in the aggregate of inventory holdings may be suggested by comparing Census and Treasury statistics. In the majority of manufacturing lines, corporations, whose returns are tabu-

lated separately by the Treasury, account for 90 per cent or more of the production shown by the Census in their respective industries. In wholesale and retail trade, however, corporations sell less than half of the total volume, and it is reasonable to believe that inventory holdings are in about the same proportion.

A similar discrepancy appears in the reports on wholesalers' inventories. A published estimate from another source found wholesalers' inventories down by 12 per cent between February 1st and the end of June, as compared with our integrated estimates of 5 per cent decline. The other estimate, based on a series of monthly reports reflected the experience of a group of wholesalers large and competent enough to make monthly reports. The average inventory decline among our top bracket of wholesalers—annual volume over $500,000—was 8.5 per cent, more in line with the 12 per cent estimate than our 5 per cent for wholesaling in total, but still a considerable discrepancy. Both studies are based on voluntary samples and there is no way of knowing which is more accurate.

The net conclusion is that trade statistics can literally go 100 per cent wrong on a bad sample or our inability to make provision for compensating the effect of a bad sample.

The method used in compiling our Dun & Bradstreet trend estimates entails a lot of drudgery and, according to the time honored moral principle that hard work is righteous, it ought to give the right answer. But are small voluntary cooperators typical of all small concerns? From our experience we have concluded that the strength of character necessary to report unfavorable news exists more often among managers of the large companies, rather than among small enterprises. We have not yet, however, arrived at the formula for compensating differences in the result. A careful study of this problem would be a substantial contribution to the technique of sampling. Results obtained from a controlled and balanced sample should be compared with results of weighting returns from mailed questionnaires on the same problem.

This bias of sampling can easily be confused with the common garden variety of statistical bias which appears in the open end bottom bracket of a classification of concerns by size. This bottom bracket will include a number of concerns which started in business just before the period covered by the Survey and if they survived at all were enjoying rapid growth during that period. Conversely, the Survey fails to reach those concerns which were going down hill during the Survey period so rapidly that they disappeared beneath the ground before the picture was taken. In a Survey intended to reveal sales or inventories

this phenomenon yields a distinctly one-sided picture and the trend ratio for the bottom size group is therefore discarded as a matter of standard practice. For instance, in most trades this means that the trend for retailers, as shown by retailers with sales of less than $10,000 annual volume, is unusable as a matter of practice. Instead, the trend shown by retailers of $10,000 to $20,000 annual volume is commonly applied to the Census weight for both groups.

The gathering of inventory data on specific commodites is a game of "button, button, who's got the button?" Inventories normally pile up at six well-known bends in the stream of distribution: (a) raw materials, (b) semi-finished goods and fabricated parts, (c) goods in process of manufacture, (d) finished goods at factories, (e) wholesalers' stocks, and (f) retailers' stocks. A jam at any one of these points will hinder the log-drive of commerce, and our plans to keep watch on all of them must ordinarily be a compromise between accuracy and expense.

The newly published inventory data from the 1937 Census of Manufactures will be vastly helpful in this respect since it gives finished goods separately. It would have been even more valuable if it had distinguished between raw materials, semifabricated parts and finished goods.

It would be impractical in many lines to gather figures continuously from an adequate sample of dealers and users, in addition to manufacturers, but a study of the normal and relative importance of stocks at these various points would be valuable background for the compilation and interpretation of commodity inventory figures.

In the case of copper, the monthly stock figures include holdings at commodity exchange warehouses as well as refineries, but the question remains as to how important relatively are the stocks in the hands of users. For instance, how logical does the history of anthracite shipments and prices appear when compared with the series of figures on stocks in producers' storage yards? It may be necessary to learn, as background, the storage capacity at producers' vs. users' and distributors' yards.

By the nature of the case, every industry has a stock of goods in process around which rages currently a vigorous accounting debate. The "residual inventory" and "first-in-first-out" advocates form a coalition against supporters of the time honored policy of valuing all inventory at "cost or market, whichever is lower." During a period when any considerable number of members of the industry are shifting their accounting practices from one basis to another, compiled figures may be misleading in that particular line. Assuming, however, that the

raw material and finished goods categories will show the variations which are significant, "goods in process" can be neglected safely in estimating inventory trends of many industries.

Though the majority continue to follow the accustomed plan, the statistician's road is not entirely clear. In many industries it is fair to ask, "What is Cost?"—and there is considerable latitude for answer. Or "What is Market?"—and the answer depends on who computes the market.

All of the foregoing discussion has been devoted to problems involved in assembling monthly or other frequent periodic inventory data. There was no intention of neglecting annual inventory figures, which can be collected on a broader scale, nor Census figures available at still less frequent intervals. The Census constitutes the permanent bench mark by which business indices and sample series measure their achievement. The inventory surveyor sighting his levels through the wilderness of several dozen intervening months, confused by a foliage of cost and market valuations, at times appalled by having to measure long distances with such a peewee instrument as voluntary sample, either has the comfort of finding that he has come out right, or the warning that he must try to compensate in his calculations for the inaccuracy of his equipment.

The speed with which 1937 Census material has been issued recently is a delightful innovation—might even seem like reckless driving if we didn't know that first-rate highway builders and drivers are in charge.

Comparative study of current data and these broader surveys over a period of years, may enable us to discern which trades behave similarly, so that the members of a given industry may guide temporarily by current data collected in an industry known to have similar inventory characteristics.

To balance these virtues of Census and annual data, it must be remembered that such infrequent surveys are inadequate to show the turning points. Of inventory holdings in some 30 lines analyzed only a few of the high and low points walk neatly on the chalk lines marking the year ends. The behavior of business judgment is seldom that sober. Yet a careful study of the high and low points in these and other series suggest that the inventory cycle may follow a pattern related to types of goods and their uses. Thus, both the bottom and top of the inventory cycle appear earliest in the case of building materials; latest in the case of manufacturers' raw materials and at scattered intervening points in the cases of consumption goods.

The appraisal of our inventory data must also consider prices.

Existing price indices commonly trace the dollar value of a given amount of materials and workmanship, but indices based on the "consumed assortment" of goods would be more desirable for application to sales or inventory series. One of the best examples of these data is the case of automobiles. When we were endeavoring in the Bureau of Foreign and Domestic Commerce to convert the Automobile Manufacturers Association unit figures into a monthly dollar estimate of automobile sales, the first move was an effort to use the price index of the Bureau of Labor Statistics. But it was quickly found that the results did not check with the dollar figures which the industry published annually. The assortment of cars which the public fancied had changed much more rapidly than the weights in the price index. The new index which was constructed especially for the purpose of converting these unit figures was the practical equivalent of a weighted average price of all cars sold each month. Still another stumbling block in the interpretation of the inventory figures is the possibility of a long-term trend in the relationship of sales to inventory. Leverett S. Lyon in his study of "Hand-to-Mouth Buying" in 1929 found a convincing number of instances where the inventory burden ratio had decreased over the previous ten years. His charts might profitably be brought up to date to learn where and whether that trend has continued, since 1929.

Seasonal stabilization of production and payrolls, where it has been attempted, has ordinarily sharpened the seasonal eccentricities of inventory. With the present Wage and Hour Law and its Administrator clubbing together to deny that anything is legitimately seasonal except the birds and the flowers, we look forward to a possible orgy of seasonal stabilization. Thus, just about as our inventory minstrels have learned the rhythm of the several industries the orchestra strikes up a new and different production tune, which may make the interpretation highly confusing if not actually discordant to the layman's ear. Without question we need more knowledge of the seasonal as well as long term behavior of this turnover ratio before our interpretation of inventory figures can be thoroughly adequate.

Another purpose of current reporting projects and annual studies, which gather both sales and inventory figures, is to discern the relative behavior of inventories and sales. Admittedly in certain trades, double the volume of business can be done without greatly increasing inventory. In other trades, almost every dollar of increased sales is accompanied by some fractional increase in the inventory investment in order to maintain a satisfactory assortment and attract customers during the upswing of the business cycle.

A recent chart by Charles F. Roos shows the sequence concisely. After three months of increasing consumer demand, early in 1936, a tremendous upsurge of orders started inventories on the upgrade at the same pitch. Inventories continued upward at that pitch until the fourth quarter of 1937 though consumer demand leveled out some time in the latter half of 1936. If, however, consumer demand had continued upward at the rate predicated by the first half of 1936, the inventories which caused such panic near the end of 1937 would not have appeared at all excessive. If adequate figures had been available on inventories sales or shipments and consumer demand, many a manufacturer and distributor could have saved himself some of the grief—or they might have hopped on the bandwagon more quickly and unanimously, only to take a worse fall, for these bandwagons have no brakes. Similarly his figures suggested in the fall of 1938 that new orders had again begun to move up more rapidly than the accepted measures of consumer demand and purchasing power, since accumulation of inventories later became evident and monthly series published in January later showed that December business had fallen off.

A fair net conclusion would seem to be that we have vastly more inventory data and accompanying sales data available to us now than was published a few years ago. Our prime problem now is in the field of interpretation, gathering the instruments which will make for more accurate interpretation of the available figures; our second job is the expansion of reporting to cover more fields of industry and trade; our third job is to relate the behavior of inventories and sales to the "working capital crises" in business.

TRENDS IN CANADIAN BOND, STOCK AND COMMODITY MARKETS 1928 TO 1938*

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It is the purpose of this paper to outline a few of the trends which have characterized the Canadian bond, stock and commodity markets over the past ten years. Special emphasis is placed upon the government bond market and upon a fairly new Canadian sensitive commodity index.

BOND MARKET

Growth of a broad domestic bond market in Canada is of comparatively recent origin, large scale financing virtually beginning with War Loan bonds issued after 1914. Prior to this time, inflow of British capital assisted the industrial expansion of the country. Since the war, United States investments have assumed growing importance, and large funds have been derived through sales of Canadian bond issues in New York and through direct investment in Canadian railways, public utilities, and industries. Estimated total capital invested in Canada at the end of 1937 approximated $18 billion,[1] of which over 60 per cent was owned in Canada, over 20 per cent in the United States, and about 15 per cent in the United Kingdom. Capital invested by Canada in outside countries amounted to approximately $1.8 billion, of which over $1 billion or 62 per cent was held in the United States and only about 2 per cent in the United Kingdom.

While United States investments in Canada were three and a half times as large as Canadian investments in the United States, it is pertinent to note that on a per capita basis Canadian investments in the United States were over three times as large as United States investments in Canada. The foregoing per capita relationship has been practically unchanged over the period covered.

Dominion, provincial and municipal securities at the end of 1937 comprised over 40 per cent of the total capital invested in Canada, and United States holdings of such securities, aggregating about $1.2 billion, were more than twice as large as those held by British investors.

At the present time, when the question of national debt is one of

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[1] This figure includes bonded indebtedness of Dominion, provincial and municipal governments, investment in railways, manufacturing, mines and metal industries, public utilities, trade, finance, insurance, land and mortgages.

paramount concern in many countries of the world, it is useful to trace changes which have occurred in Canada's funded obligations over the past ten years. Confining analysis to the federal direct and guaranteed funded debt[2] (which incidentally comprises more than half of the Dominion, provincial and municipal total), the per capita debt in the first half of the period—that is, from 1928 to 1933—increased by about 11 per cent, and in the remaining five years—from 1933 to 1938—by about 8 per cent. Anomalous as it may seem, however, despite successive increments in the public debt itself the average rate of interest has continuously decreased throughout the entire period, a rate of 4.90 per cent in 1928 comparing with 3.75 per cent in 1938. The explanation, of course, is traceable to prevalence of low interest rates which have enabled financing to be carried out at declining cost. So-called "easy money" has facilitated reduction of government bond interest to such an extent that the per capita annual carrying charges on the federal debt in Canada at March 31st, 1938, were about 8 per cent lower than they were at March 31st, 1928.

In the past ten years repatriation of funds has been a characteristic trend in public financing. For each of the three calendar years 1928–1930, for example, United States and United Kingdom markets absorbed more than half of our government and municipal borrowings, whereas in the eight years 1931–1938 inclusive this proportion averaged less than one-fifth. The following table indicates the volume of public financing, by markets, over the past decade:

DOMINION, PROVINCIAL AND MUNICIPAL BOND FINANCING IN CANADA, 1928 TO 1938

(Exclusive of Treasury Bills)

Calendar year	Sold in Canada	Sold in U.S.A.	Sold in Great Britain	Total
1928	$ 68,448,924	$ 66,359,500	$17,650,000	$152,458,424
1929	148,622,124	175,963,198	16,959,000	341,544,322
1930	205,196,618	241,744,100	6,870,000	453,810,718
1931	1,085,373,104	113,854,000	2,217,000	1,201,444,104
1932	365,784,835	82,535,000	13,578,333	461,898,168
1933	395,745,279	60,000,000	73,000,000	528,745,279
1934	477,438,112	50,000,000	56,063,866	583,501,978
1935	502,083,368	96,000,000	—	598,083,368
1936	468,903,022	88,000,000	—	556,903,022
1937	460,680,652	88,250,000	—	548,930,652
1938	350,249,024	40,000,000	48,666,666	438,915,690

TREASURY BILLS

Calendar year	Sold in Canada	Total
1934	$ 50,000,000	$ 50,000,000
1935	283,300,000	283,300,000
1936	510,000,000	510,000,000
1937	585,000,000	585,000,000
1938	620,000,000	620,000,000

[2] Gross amount outstanding, including temporary loans but excluding school land debenture stock, discount Treasury Bills and all matured items.

Another distinctive element in the Canadian debt structure is the two-or-three-way optional payment bond, with interest payable at the holder's option in New York, London or Canadian currency. Many of these optional payment bonds were issued prior to 1931, when the probable adverse effect of repayment in two or three currencies appeared to be outweighed by comparatively stable exchange rates and the attractive market appeal of the optional feature. With the subsequent decline in the Canadian dollar, however, disadvantages of the optional payment obligation became apparent. As a result, there has been a gradual diminution in the amount of optional payment bonds. In 1937 the Dominion retired the last of its optional payment direct debt, but a substantial portion of outstanding Dominion guaranteed and provincial debt is still subject to the two-or-three-way payment feature. In the Province of Ontario, for example, roughly one-third of the total debt outstanding at December 31st, 1938, was subject to three-way payment in New York, London or Canada.

A policy in Dominion financing over the past ten years has been the exclusive flotation of taxable bonds. At March 31st, 1929, for instance, almost half of the Dominion's direct outstanding debt consisted of tax exempt Victory Loan issues, the last of which was retired in 1937. Today there are no Dominion, provincial or municipal bonds outstanding in Canada which are free from Dominion income tax, and, with some exceptions, succession duties also apply.

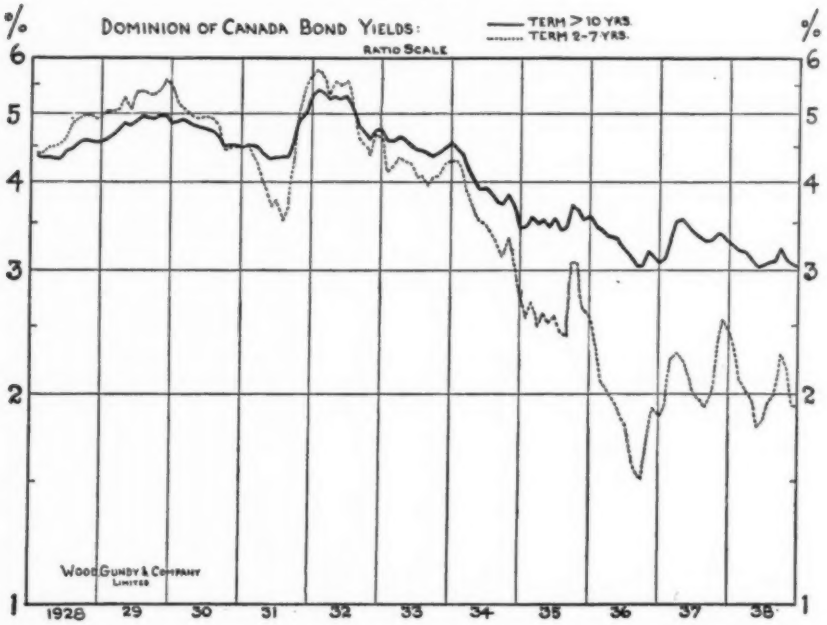
Perhaps the most significant trend in the Canadian government bond market during the period under review has been the development of shorter term financing. Ten years ago government bonds of comparable credit status sold at approximately the same yield, irrespective of term to maturity. From 1933 on, however, unprecedented expansion in volume of bank credit, due partly to the pronounced decline in commercial loans, resulted in greater demand for more liquid short term investment. As a consequence, yields for short term government securities tended to fall below rates for longer term bonds of the same grade.[3]

In Canada, the separation in yield between short and long term bonds was effective in promoting a short term money market with the sale of three-month Treasury Bills by public tender through the newly established central Bank of Canada. Prior to this time similar loans had been made privately to the chartered banks by the Dominion Government.

[3] In this connection it is significant to note that the widened differential in yield between short and long term bonds recently prompted the Federal Reserve Board to revise its bond yield averages, replacing treasury issues due or callable after eight years by those having twelve years as the minimum term.

Broadly speaking, bond yield trends in Canada have synchronized with those in the United States for the past decade. In the highest

CHART I



grade market, as shown in Chart II, the correlation has been particularly marked.

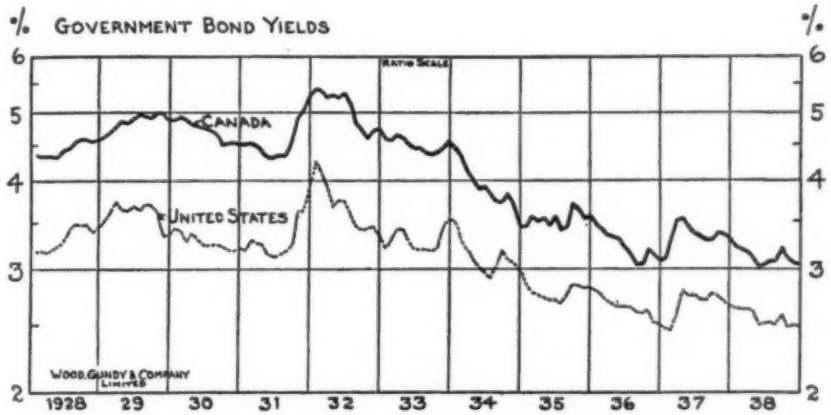
At the time of the Czechoslovakian crisis, Canadian bonds reacted more than United States issues but not as severely as British government issues in London—a relationship which would naturally be expected from political events directly involving Great Britain. For instance, in the last few days of September, Dominion of Canada 3 per cent bonds due 1950–1955 fell about three points, United States Treasury 3 per cent bonds due 1951–1955 dropped less than one point, and the British conversion 3 per cent bonds due 1948–1953 lost more than five points. The sharper drop in Canada, relative to the United States, is not disclosed by the monthly averages shown in Chart II, due to the short duration of the reaction and to the almost immediate recovery.

With respect to the corporation bond market, there has been little activity since 1929 so far as new borrowing is concerned. A number of companies, however, have taken advantage of low interest rates for refunding purposes and, in several cases, corporations holding bonds

abroad have repatriated issues by internal flotations. To the writer's knowledge, there is no currently published index for average yields of corporation bonds in Canada, but a special series prepared for 1929–1937 indicates marked similarity with indices for the United States.

In summary, amongst the chief features of the Canadian bond market over the past ten years have been repatriation of funds, emphasis upon shorter term borrowing, inactivity of new corporation financing

CHART II



and reduced carrying charges on public debt. In view of the character of bond market financing in the last three years, through persistence of "easy money," it seems reasonable to conclude that low yields have been maintained because of governmental exigency rather than business expansion. However, the merits and demerits of managed currency as exemplified by an "easy money" policy are obviously matters of controversy.

STOCK MARKET

Generally speaking, trends in the Canadian stock market are predicated almost entirely by movements in New York, and adequate comments concerning these are more properly left to experts in that special field. As we would expect, major interest on Canadian exchanges has been centered in base metals and golds and, in the past two or three years, to a limited extent, in oil stocks as well.

COMMODITY MARKET

Prices in Canadian commodities have followed trends very similar to those in the United States over the past decade, though levels in

Canada were somewhat lower from 1934 to the early part of 1937. In the past two or three years, so-called sensitive indices have attracted so much attention that early this year we undertook the construction of such an index for Canada. A sensitive commodity index for Canada is subject to the limitations of a country which lacks organized and highly developed commodity exchanges. In general, with the possible exception of grain and dairy products, we have no commodity markets of our own. Under such restrictions, while a commodity index for Canada cannot purport to supplant or improve upon indices published for the United States and the United Kingdom, it can nevertheless provide a useful measure for Canada itself.

For a sensitive index which would be representative of the Canadian economy, it seemed essential to consider raw materials of leading export value. Wheat, bacon hogs, zinc, lead and copper reflect this aspect in our index and form half of the total ten items in the composite. The remaining five—namely, cotton, wool, rubber, steel scrap and hides—were chosen as suitable sensitive indicators of Canada's imports and domestic needs.

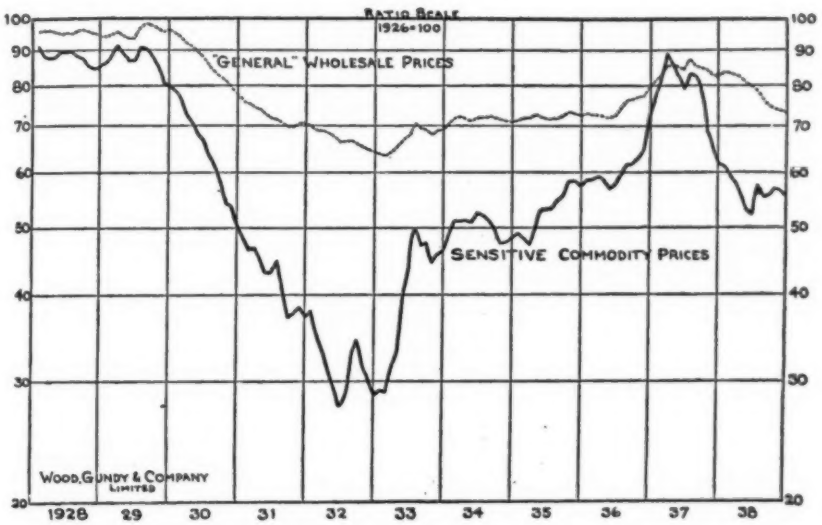
Newsprint (Canada's leading export in 1938), crude petroleum (the leading import), nickel (the fourth export) and other important commodities which might seem obvious constituents for a Canadian index, were precluded either because of their fixed price or lack of sensitivity. Even so, the selection made is regarded merely as a tentative one to be improved or changed as time goes on. It is possible, for example, that it may be feasible to include a representative of the forest industry, which is of such importance in Canada, but so far no appropriate quotation has been found.

The method used in the construction of this index is that of the unweighted geometric average based on 1926 equals 100. Individual weights were not assigned to the several commodities as tests indicated no consistent correlation between quantity and price, and the relative importance of the several industries represented has altered so appreciably that a system of constant weighting seemed inappropriate. Seasonal adjustments were not made, partly because only one item showed any pronounced seasonal tendency and partly because the index aimed to present a weekly measure of the sensitive commodity trend and earlier data were only available in monthly averages. Further consideration of the seasonal factor for monthly averages, however, is in process.

The high degree of sensitivity exhibited by the resultant index as compared with general wholesale prices is evident from Chart III.

Both in timing and direction the Canadian sensitive commodity index closely follows the broad trend of Moody's Spot Commodity Index for the United States. As in the case of general wholesale price indices for the two countries, however, the Canadian sensitive measure recorded lower levels than the comparable United States measure from 1934 to early 1937.

CHART III



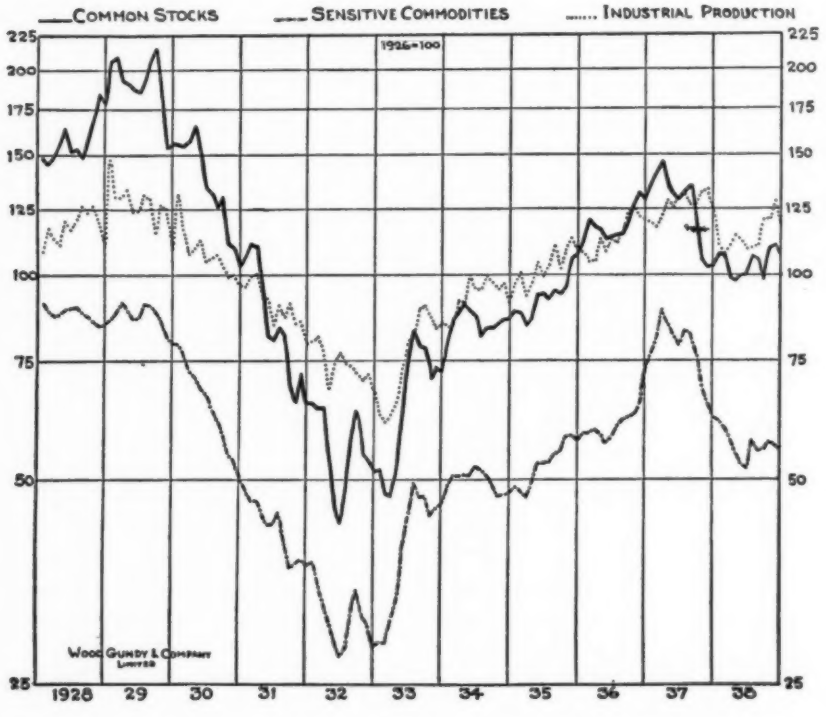
Since sensitive commodity price trends have an important bearing upon profits and earnings of industrial companies, they have a direct relation to pertinent holdings on the stock market. Over the past ten years the indices for sensitive commodities and common stocks[4] have shown a very high degree of correlation, as shown in Chart IV.

In particular we observe that both indices record the monthly low for the 1930–1933 depression in June, 1932, and the high of the 1936–1937 recovery in March, 1937. Both indices have registered extreme declines in the last two business recessions. From September, 1929, to June, 1932, the common stock index declined by approximately 80 per cent, while over the same period the sensitive commodity index decreased almost 70 per cent. From March, 1937, to June, 1938, the stock index dropped 32 per cent, while sensitive commodities dropped more than 41 per cent.

[4] Neither of the two large stock exchanges in Canada have computed monthly averages prior to 1934, but the general index of common stocks prepared by the Dominion Bureau of Statistics represents the trend in the industrial market fairly well.

The trend of industrial production in Canada, which is also plotted on Chart IV, has shown marked similarity with the sensitive commodity index for the past decade. Sensitive commodities declined more sharply and earlier than industrial production both in 1929 and 1937, indicating weakness of demand relative to supply and existence of over-production.

CHART IV



References: *Bank of Canada Statistical Summaries; Canadian Political Science Journal,* "The Course of Actual Interest Returns since 1929 (May 1937)," "Bank Cash (August 1938);" *Dominion Bureau of Statistics* Reports; *Federal Reserve Bulletins; Moody's Investors Service;* and *Wood, Gundy & Company Limited* statistical records.

SOME PROBLEMS IN TEACHING ELEMENTARY STATISTICS*

By Lester S. Kellogg
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Two years ago, in a session similar to this one, the subject of teaching statistics in schools of business administration was treated, largely from the point of view of graduate schools, rather than from that of undergraduate schools. At that time Professor Theodore H. Brown of Harvard University pointed out that courses as usually given in colleges at present have been of little assistance in solving the specific problems of business men. He discussed (1) teachers, (2) types of courses, (3) mathematical prerequisites, (4) and some of the problems of course outlines. Professor Theodore J. Kreps of Stanford, in his paper, emphasized the development of judgment in the use of statistics. He presented a set of criteria for teaching the elements of statistics and illustrated how they might be used. Professor Blackett of the University of Michigan described the teaching of statistics at his institution. In the period following the papers, the philosophy involved in the different treatments presented was discussed. But a number of us who were present felt that the problems faced in most schools of business, and at the undergraduate levels particularly, were not satisfactorily treated.

I shall not presume to say that I know the problems relative to the teaching of statistics in all, or even very many, colleges, but I do know the situation that exists in several schools—both large and small. In describing this situation, there are several aspects which must be considered separately—first, the attitudes and reactions of students to courses in statistics, and second, the relation of courses in statistics to the curriculum of the school of business, and to other courses in the University.

Students frequently *fear* courses in statistics. This problem has been studied in some schools and could well stand investigation in others. Reasons in great number have been advanced for this situation. Although I make no pretense as a psychologist, an outstanding explanation which may or may not have merit is that statistics requires a great deal of work, and students in general don't like to work. It is true, I presume we can all agree, that the technical vocabulary used in statistics is different from that commonly employed by students or

* A paper presented at the One-hundredth Annual Meeting of the American Statistical Association, Detroit, Michigan, December 28, 1938, in a joint session with the Institute of Mathematical Statistics.

employed in other courses. Consequently, the mere reading of a statistics textbook requires considerable patience and concentration. But it is hard to believe that this reason is very fundamental. The basic causes of this fear, I think, are of a different order.

Primarily, the fear may be due to a lack of acquaintance with arithmetic and mathematics. If this is the case, many schools have abetted the situation by deferring the courses in statistics until the junior or senior year; the longest possible period from high-school mathematical training, unless a college prerequisite is established.

The fear, however, is probably due to a number of other factors, one of the most important of which is an institutional build-up for statistics instructors, which, if not actually directed, for one reason or another has been permitted. The grading done by statistics instructors, for instance, has so frequently been extremely different from grading done by instructors in other courses of the same level that students have had good reason to fear the course—but mainly the grade. Severe grading of this kind may have several causes: Bad instruction, a superficial sense of responsibility on the part of the instructor, students with poor backgrounds or no intelligence, lack of regard to grading policies on the part of instructors in other courses, or perhaps some combination of these and others. Although this kind of grading has frequently caused difficulty for the college administration, there has really been but one major result, the defeat of the aim of the course, for in this kind of a grading problem, even good students suffer a psychological reaction that handicaps them.

In many elementary courses, considerable emphasis is sometimes put upon algebraic manipulation in spite of there being no satisfactory prerequisite of mathematical courses. In the early stages of the course, usually, very little effort is made to re-orient students in arithmetic and simple algebraic operations, because the college course in statistics cannot take the responsibility for this kind of elementary training. Students are frightened at the prospect of mathematics they don't understand much more than at statistics. It must be admitted that this is an unfortunate basic confusion.

In most schools of business, a first course in statistics is required for a degree, but frequently it is not offered until the junior and frequently the senior year. Fortunately, there has been a tendency in the last several years to move the course downward in the time sequence of the curriculum. When it is required in the senior year, however, several serious consequences ensue. The fear complex is increased. Required for graduation, students realize that failure in this one course

means failure to graduate, with no hope of recoving within the customary four-year period. Many otherwise average students have failed this hurdle. Pressures as a result have been put upon the instructors in the course, even though his may have been a good teaching job. But against this combination of factors which makes such a serious handicap to his work, the instructor can do little.

There are other serious consequences of putting elementary statistics courses late in the curriculum. First, there is little or no opportunity for a student to exercise the technical or semi-technical jargon of the subject, or to practice the methods which he has learned in the work of his other courses. It is usually agreed, I believe, that tools should be provided early in one's training, and that skill in the use of the tools results from practice. In this case the tools are provided too late for practice, in spite of the fact that other tool courses, such as accounting, are started early in the college course—in the freshman or the sophomore year.

Secondly, and just as serious for the development of the use of statistics, when the elementary course is delayed to the end of the college course there is little opportunity to increase the statistical offerings in the curriculum and there is no chance, short of graduate work, for a student to take advanced courses. This is unfortunate for the student who wants a broader training in the field of statistics.

The old argument as to whether statistics is a pure subject and can be taught as mathematics is taught can only have a deleterious effect on the subject. Confusion arises in aims and among students when several different departments teach statistics from several special points of view. The student is justified in his confusion, for in these different courses there are different aims, different approaches, different contents, and different emphases.

It seems to me that these situations in many schools raise an area of problems in which the professional association has a responsibility. In the first place, these problems and consequent responsibilities involve the necessity for, first, a general determination of the functions and aims of courses in statistics, particularly at the undergraduate level. Secondly, the philosophy of relating the statistics course to other parts of the curriculum, and third, the establishment and maintenance of professional standards.

The first of these problems, the determination of the function of elementary statistics, is the one which is probably of greatest current interest to all of us. In its answer is the guide to our teaching schedules, the grounds for our textbook selection, and the basis for our choice of

laboratory problems. Unfortunately, in most cases the functions are never specifically enough defined to be a good guide. Two years ago Professor Kreps' paper listed the qualifications in statistics which are especially necessary for the rank and file of commerce school graduates. They are:

1. A familiarity with the existing statistical publications and sources,
2. Habits of accuracy, to which I should like to add routines and orderly procedures,
3. Ability to present results with clarity and simplicity, to which I want to add:
4. An acquaintance with the standard terminology of the subject.

It is clear that these functions may not be accepted in all situations. But, it seems equally clear that unless some specific objectives are established there can scarcely be any satisfactory criteria for generally testing the results of our work in a first course in statistics. The philosophy of the different schools and colleges must be considered at this point, for, in college where the subject of theoretical economics has a dominant position, the aims of a course in elementary statistics may be differently couched than in schools where the business organization or marketing forces predominate. If the aims of this elementary tool course are considered objectively, however, it is difficult to see why the aims should be materially changed.

The second problem, that of relating elementary statistics to the established curriculum, is raised fundamentally between the mathematics department and the school of business. If statistics is basically mathematics it should be presented in that department, it is maintained. On the other hand, if elementary statistics is only incidentally mathematical there is no reason why it should not be given in the field of its application. Even if it is admitted that the course should be given in its applied field the issue mentioned a few minutes ago, whether elementary statistics should be economic statistics or business statistics, is sure to arise. And a further complication appears, for, as Professor Brown pointed out, even the so-called business statistics usually deals with a different level or variety of problems than is actually faced by the average business man or by the young man in the position in which he will start his business career.

Of still greater importance from the point of view of the teacher in the school of business, however, is the articulation of the statistics course with the materials and approaches used in the other courses in the college. Although the problem of course integration and articula-

tion is an internal one which must be handled for the most part by the college administration and curriculum committees, it is a problem which cannot be overlooked in determining the general functions of a course in elementary statistics.

The development of professional standards is the third problem and because of growing importance of the profession, in view of the great increase in interest and use of statistics and the lack of an accepted solution to the problems I have mentioned as one and two, it is a very important one. The impetus given to statistical research by the application of statistics in the field of marketing, and the use of statistical methods in many branches of business and social control has led tothe use of the appellation "statistician" by all manners of trained and untrained persons. Of course the Civil Service Commissions have their own standards and examination criteria for the several grades of statisticians which are more or less effective in a few governmental areas. But the Commissions have a relatively restricted area of operation and appear to have little or no indirect effect, even in some governmental areas.

The question of professional standards has been faced by at least one chapter of the American Statistical Association during this past year. In July the Albany, New York Chapter issued a preliminary report by its committee on "Professional Standards for Statistical Workers" with especial reference to statisticians in state government employ. This group has been working toward the establishment of criteria for selection of statisticians for state service. But the question which was posed in the American Statistical Association *Bulletin* in May, 1938, "What Is a Statistician?" remains unanswered. Business men want to know, the public would like to know, W.P.A. clerks think they do know, but most of all before effective training can be provided, teachers must know.

The improvement of the situation in colleges which I mentioned earlier, that of student attitude toward courses in statistics, can be temporarily accomplished by local adjustments, but the solution cannot be provided until the three problems dealing with function, articulation, and professional standards have been faced and solved.

Temporary improvement may also be accomplished by a revision of teaching programs and by a change in teaching techniques. By revision of the teaching programs I mean the making of changes of at least three different kinds. The first is that of reducing the amount of work covered in the period of the course. An examination of courses in American colleges would likely disclose that elementary statistics is planned to

complete one of the beginning texts in the period of the course, irrespective of whether that is one quarter, one semester, or two semesters. In most cases I feel that one effective solution would be a reduction in the ground covered with greater emphasis on several phases of the subject which are frequently treated too mechanically if at all. Very few courses so far as I can find, for instance, pay even a little attention to the questions of accuracy and significant numbers. I feel that very few students comprehend either of these problems. Statistics textbooks, for instance, do not bother to answer the question "How far should I carry the division" or "How many digits should I carry." It's not unusual to see students in statistics laboratories carry as many digits as are provided, or carry the full capacity of the machines they are operating. Students have not been trained to save time by carrying only as many digits as they need or as there are significant figures in their data. Perhaps this is one way of permitting students to use their judgment in reducing work and eliminating for the instructor the necessity of shortening the problems or of making them come out even.

The second phase, which is basic in accounting and usually entirely disregarded in statistics is that of the development and use of standard ruled forms which may be employed in facilitating accurate transposing, compilation, or construction of tabular material. The habits of orderly work are hard to develop in students and, in general, courses in statistics have not facilitated habit forming of this kind by providing the method and requiring the practice. In accounting, for instance, the different rulings of paper which are commonly used, and the positions of debits and credits are drilled into students very early in the course. There is nothing quite comparable in statistics.

A third phase which is too frequently slighted is sound training in data search. By all odds the greatest number of telephone calls I get in our Bureau of Business Research, either from business men or students, are requests for data or for sources of data. It is the unusual business which knows even the sources of data concerning its own line of industry. A detailed study of the sources of data and the methods of locating them would be an almost invaluable addition to the training offered in every first course in statistics. A first course which would treat a smaller content but treat that content in greater detail might aid in reducing the inhibitions of students toward the subject and in increasing the effectiveness of the course.

Another aspect of changing the teaching program is that of shifting the elementary course down to the freshman or sophomore year and thereby providing time for an increase of course offerings. If the first

course is given early in the college sequence there is a shorter lapse of time between the student's last mathematics course and consequently a better chance of articulating his high school mathematics with the algebra and arithmetic of statistics. There is also an opportunity for a student to practice in his other courses the statistical techniques he may have learned. The greatest advantage may be that such a plan provides a chance for greater offerings in the field and for the student to take more advanced work in statistics.

By changing teaching methods temporary improvement may be accomplished. The lecture method it seems to me is questionable for statistics and yet it is still used in many schools. There have been some tests made of the general effectiveness of this method, but I have not heard of those tests having been conducted relative to technical courses such as statistics. It seems to me safe to say, however, that improvement might be expected with a reduction in lecturing and an increase in the use of the laboratory. Even with large enrollments I have seen the successful use of specific research problems for five or six smaller groups of the class. There is no question but that this method is costly in time, but it does make the problems live for the students and it gives them an opportunity to see the variety of problems that can arise. A uniform final examination may be more difficult under this system for it is likely that all students will not have become acquainted with precisely the same methods. Statistical judgment, one of the possible major aims, however, is developed by this method.

We have experimented with another method. We have assigned N.Y.A. freshman students without previous training to our Bureau of Business Research, and after a few days on calculating machines, have given them certain minor responsibilities in our regular routine. Work of this kind has involved compilation of data—hence work on sources, graphing, and computations of many kinds under a rigid habit forming system of checks. We have not examined the results of this work by objective tests, but we are confident that we are turning out students who can more nearly meet the needs and desires of business men than those who spend a term in one course in statistics.

I have said that these revisions in program and changes in methods would only provide a temporary or partial solution. I think that the only long run solution lies in a recognition of the situation and its problems and a rational attempt by a responsible group to study them and make recommendations.

Being mainly interested in business statistics, I believe the American Statistical Association should provide in one of its committees a group

for the continuous study of the problems related to the teaching of statistics. This group would have as its first responsibility that of determining the function or place of statistics at the undergraduate level in schools of business. A generally recognized definition or standard would be helpful not only to teachers in planning their courses, but also to administrators in selecting their instructors in the field. Its second task might be to outline an acceptable or preferable content and indicate points of emphasis of courses for the undergraduate level. Another responsibility would be a consideration of professional standards in the field of statistics. There have been suggestions indicating that statisticians should follow the accountants in establishing standards which will aid the public and enable laymen in evaluating the profession. Perhaps a separate group should work on this question of professional standards. The very fact, however, that many of the problems are so elusive makes the job a very difficult one, but one which nevertheless is in great need of being done. Because of the importance of these problems for the future of statistics, we ought to urge our Association to face them and hold ourselves cooperatively responsible through our Association for solving them.

DISCUSSION

In general I am in agreement with Professor Kellogg. Several additional reasons why students fear statistics and postpone the introductory ocurse as long as possible are:

1. They fear the unknown. This is due primarily to the fact that at registration time most or all of the advising work is done by older members of the faculty (deans and department chairmen) who have a very vague concept of what business statistics is. These men received their training before courses in business statistics were offered or they took courses in economic statistics or mathematical statistics. When a freshman or sophomore asks one of these advisers what business statistics is, the answer is vague or misleading—perhaps including a discussion of collecting a hundred leaves from the ground, measuring their lengths, classifying them, and forming a frequency distribution. When the student contrasts this with a more definite and correct discussion of courses such as investments, corporation finance, accounting, marketing, business organization, etc., the student chooses to postpone business statistics.

2. The course in business statistics is the first one the student encounters in the school of business which necessitates the use of elaborate equipment in the statistics laboratory. In other courses students develop the habit of studying late at night, early in the morning, or during slack periods on various part-time jobs around the city. As the first course in business statistics requires the student to set aside several hours each week and preferably each

two-day period for work in the statistics laboratory, students must change their habits of studying and working. They attempt to postpone such a change, thinking that they can get the work done somehow. This results in a large number of incomplete grades or failures. Both grades delay graduation.

The problem of moving the first course in statistics to the Sophomore or first half of the Junior year was faced at the University of Missouri some time ago. Such a step had to be taken for we give four undergraduate courses in business statistics (a total of 13 semester hours). As most students take 7 semester hours and many take 10 or 13 semester hours of business statistics the introductory course had to be placed early in the sequence of courses. Such an arrangement has proved very satisfactory, for this is a tool course, covering training and methods which should be used by students in other courses, such as Corporation Finance, Investments, Marketing, various accounting courses, etc.

Professor Kellogg has discussed briefly the relation of courses in statistics to the curriculum of the school. I believe that the work in business statistics should be integrated with the work in accounting. In reality accounting is but one part of the field of business statistics and there is no reason why there should not be one introductory course in business statistics and accounting, for accounting is merely a routine or ritualistic application of the principles of classification, which is the simplest kind of statistical work. The other subjects discussed in accounting are really parts of business statistics. Depreciation is one illustration, and a knowledge of time series analysis (more specifically, the determination of secular trend) includes everything one needs to know to determine depreciation. The actual recording of the depreciation on the books might be called accounting, but the determination of the proper amount of depreciation is a part of business statistics. We have here an illustration of one part of the field of business statistics developing faster than the rest. This has led to an unfortunate attempt on the part of accountants to swallow the whole field of business statistics by using such terms as cost accounting, sales accounting, etc. Sales accounting is merely a poor name for sales analysis, which is a part of business statistics.

Another advantage of having an introductory course in business statistics and accounting arises out of the fact that most large and many medium size business organizations are using punched card sorting and tabulating equipment to record, classify, and tabulate all accounting data. This eliminates the hand posting from the journal to the ledger. Business statisticians have adopted the use of such equipment while accountants have lagged behind. The manufacturers of the equipment are using good psychology in changing the name of the tabulating machine to the electric accounting machine, probably on the assumption that accountants are so narrow or routine minded that they never think of anything that does not have the word accounting connected with it.

Regardless of what else is put into the first course in business statistics, I believe that such a course should always consider the problem of sampling

and tests of significance or reliability. The current tendency to treat only the so-called descriptive aspects of statistics in the first course and take up later the problem of sampling is unfortunate. An illustration is the division by N to obtain the standard deviation in the first or descriptive part of F. C. Mills' text and the division by $N-1$ when any use is made of the standard deviation in practical business problems. It is difficult, if not impossible, to find a practical case in which a business man is interested solely in the "descriptive" aspects of statistics. In this connection I would use the bead-sampling machine demonstrated by Mr. Leavens in the introductory course rather than in a second year course, as is done at the Harvard School of Business Administration. I would not postpone the use of the machine to even the second semester, for as soon as the arithmetic average is computed the business statistician needs a measure of its reliability. I would say that the second month rather the second semester or the second year is the time when the machine should be used in the classroom.

In closing, I should like to point out that the time has come for us to recognize that the teaching of business statistics is no longer a side line. It is unfortunate to find the advisers of a graduate student drawing up a program of courses for the Doctor of Philosophy Degree in economics and "throwing in" one undergraduate introductory course in business statistics with the expectation that the student can be recommended as qualified to teach a course in economic or business statistics if he needs to do so. If it is considered wise to schedule four undergraduate courses to train a business statistician, I cannot see the logic in expecting one course to qualify a person to teach business or economic statistics. There are far too many colleges and universities in which a course in business or economic statistics is being given as a side line by economic theorists, sociologists, psychologists, mathematicians, etc.

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THE PURPOSE AND METHOD OF MEASURING PRODUCTIVITY*

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Productivity measures may serve various purposes and the method of measurement will depend upon the purpose of the analytical inquiry or the social policy to be formulated or administered. The measures of productivity which will be discussed in this paper were developed in the course of a study of unemployment conducted by the National Research Project of the WPA. The central question concerning unemployment today revolves around the possibility that the current unemployment problem is of a different nature from those of the past. The problem is in part one of the changing structure of the economy and the relationship of this factor to the prospects of future employment. Within the context of this problem arises the question concerning the bearing of the changing productivity of labor on the total volume of labor utilized.[1]

The effect of changes in productivity on the total volume of labor time employed depends on the volume of production and on the types of goods produced. In order to analyze the economic relations involved in the volume of labor time utilized it is, therefore, necessary to construct measures of both production and of labor productivity for each of the several commodities produced.

In addition to problems of analysis, the extent and duration of unemployment today raises a number of questions of government policy. Considerations of the responsibility of government to provide for the needy, the tremendous social cost involved in the waste of human skills and energy, and the resulting lack of purchasing power, direct public attention to the development of a long-term program to provide aid and economic security to all. To plan such a program intelligently, it is necessary to know the relevant facts concerning previous volumes of unemployment and to estimate the probable future volumes of unemployment. Should the concrete program dictated by public policy take the form of providing work relief for all the unemployed in order

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[1] Changes in productivity are the result not only of changes in machine technology, but in the organization of the productive process which affects the plant layout, division of labor, increase in the speed of operation of individual employees, etc., but also of such changes as the relative importance of plants having a higher ratio of output per man-hour and the percentage utilization of capacity. Hence, in order to fully explain the reasons for changing productivity in a given industry, it is necessary to make a detailed study of the economics and technology of that industry.

to utilize their experience and to maintain their skills on useful projects, then the inquiry would have to be directed to the question: Where are the unemployed and who are they? There are therefore two lines of inquiry with which such a government program would be concerned, one with the future *volumes* of employment and unemployment, and another with the geographic distribution of the unemployed labor force according to their skills and occupational characteristics.

We are here dealing with only the first of these problems, which centers on the answers to the following questions: How much employment and unemployment would there be if we again attained the production levels of 1929? How much production is necessary in order to employ the 1929 or the 1938 labor supply? In more generalized form these questions are of the following two types:

1. What relative volumes of labor time are required to produce a given composite of products at different times?
2. What relative volumes of production of a given composite of products are obtainable at different times with a given amount of labor time?

These two questions determine the required statistical measures of unit labor requirements and productivity. The statistical data necessary to answer these questions are (1) the quantities of each product produced and (2) the corresponding man-hours utilized in their production.[2] The answer to the first question can be obtained by computing a ratio of the aggregated labor requirements for a given composite of products at different times. This gives us a measure of average unit labor requirements.

The second question refers to the production that can be obtained with a given labor supply, and defines the desired statistical measurement of labor productivity. The assumption implicit in the use of this question is that there exists a sufficiently large and diverse unemployed labor supply which would be reemployed if production increased. Hence interest centers only on *volumes* of employment and unemployment; and qualitative differences in skills, occupations and efficiency of the individual employees need not be taken into consideration. Labor may be considered as homogeneous, and its unit of measurement as an hour of undifferentiated labor. The measure of the volume of labor time is, therefore, the total man-hours utilized in industry.

Since the question is to what extent the unemployed would be reem-

[2] We are not concerned in this paper with the technical problems of measurement arising from the lack of necessary statistical data and the inadequacy of the available data. It is assumed that the required comparable data on quantities and man-hours are available in sufficient detail.

ployed under conditions of rising production and increasing productivity,[3] the volume of production of individual commodities becomes significant only in so far as more or less labor is required to produce them. Moreover, since labor time may be considered homogeneous for our purpose, it is possible to measure quantitatively the relative changes in the volume of a specified group of diverse products in terms of man-hours. This approach is analogous to that required in the construction of measures of production and prices for the purpose of analyzing fluctuations in the volume of trade. For that purpose the ultimate unit for measuring production is a pecuniary one.[4] We, on the other hand, are interested in the volume of production as related to the volume of labor utilized, hence the logical measure of production for our purpose is in terms of labor time.

The necessity of clearly defining the criterion for measuring the relative importance of diverse products can be seen in the following illustrations for the Cigars and Cigarettes industries. The index of unit labor requirements for the two industries combined, when derived by use of a production index based on value weights is in 1926 higher than either the unit labor requirements of the Cigars industry or the Cigarettes industry separately; after 1929, the index of average unit labor requirements of the composite is lower than that for either industry. Since our problem is to determine the volume of labor required to produce cigars and cigarettes at different levels of production and productivity, the composite index of production derived by using value weights is misleading. For this index results in a measure of unit labor requirements which understates the labor required after 1929 to produce the 1929 volume of cigars and cigarettes. On the other hand, the composite unit labor requirements index obtained by weighting production with man-hours, measures relatives of the total labor required in any one year to produce the 1929 output.

The index of unit labor requirements is conceptually very simple. It answers a specific question concerning the relative volumes of labor time and comprises ratios of *aggregates of labor time*. However, the fact that the different products are measured in diverse physical units pre-

[3] The term "labor productivity" as used in this paper has a definite technical meaning, confined to the ratio of production to labor time utilized. Though the ultimate unit of measurement of labor time is one hour, there are questions concerning the productivity of labor which may require the use of other labor time units, such as a man-day or man-week. In this paper we refer to only two measures of productivity: output per man-hour and output per wage earner.

[4] See, for instance, Arthur F. Burns, "The Measurement of the Physical Volume of Production," *Quarterly Journal of Economics*, Vol. 44, p. 251; Edward E. Lewis, "Some Basic Problems in Index-Number Theory," *Economic Essays in Honor of Wesley Clair Mitchell* (New York: Columbia University Press, 1935), pp. 271–278; Gottfried Haberler, *Der Sinn der Indexzahlen* (Tübingen: J. C. B. Mohr, 1927), pp. 64–68.

cludes the direct measurement of aggregate production or productivity in a similar manner. We have already shown that the criterion of comparing the relative importance of different products is, for our purpose, the number of man-hours required to produce a unit of each product.

TABLE 1

INDEXES OF UNIT LABOR REQUIREMENTS FOR CIGARS, CIGARETTES, AND FOR CIGARS AND CIGARETTES COMBINED, 1919–36

(1929 = 100)

Year	Cigars	Cigarettes	Cigars and cigarettes: number based on composite production indexes constructed with	
			Value weights	Man-hour weights
1919	122.9	323.3	222.0	150.8
1920	110.0	348.2	233.1	143.2
1921	125.9	259.2	214.6	144.3
1922	123.7	227.4	200.5	138.1
1923	121.7	182.4	176.4	130.1
1924	116.4	164.5	158.2	123.1
1925	116.1	145.7	144.9	120.3
1926	109.8	123.8	128.1	111.7
1927	112.5	129.4	127.3	114.8
1928	109.2	129.7	117.8	112.1
1929	100.0	100.0	100.0	100.0
1930	101.5	95.0	94.5	100.7
1931	86.7	92.6	80.2	87.6
1932	95.4	89.9	81.3	94.6
1933	88.2	81.6	70.9	87.3
1934	79.2	98.3	64.3	81.9
1935	66.5	88.6	52.8	69.6
1936	63.9	73.3	47.9	65.2

However, the method of using these man-hours as weights and the type of average must be determined in relationship to a more specific definition of the purpose. The measures we seek should be consistent with aggregates of labor time and should satisfy the questions posed above. Hence the necessary index of production is one which, when divided into the relatives of total man-hours, will yield an index of unit labor requirements which measures "the relative changes in the volume of labor required to produce a given composite of products." Thus the same measure of the average unit labor requirements should be obtained either by (1) aggregating the labor requirements for the indi-

vidual items in a given composite of products and reducing these aggregates to relatives or (2) dividing the relatives of total man-hours by the proper index of production. Then $L = M/Q$, where L represents the index of unit labor requirements, M the relatives of total man-hours and Q the production index.

Likewise, the same measure of productivity (which is the reciprocal of the measure of unit labor requirements) should be obtained whether (1) the indexes of productivity for each product are averaged with appropriate weights or (2) the index of production is divided by the relatives of total man-hours. Then $P' = Q/M$, where P' represents the index of productivity.

Now, changes in the labor requirements per unit for a group of products arise out of the joint operation of two factors: changes in the labor requirements per unit of output of the several products and changes in the relative volume of output of the several products. Thus, in order to analyze changes in the unit labor requirements for a group of products, it is necessary to eliminate the factor of changing composition of production and to formulate questions only in terms of a "*given* composite of production."

The selection of the "given composite" for which unit labor requirements are to be measured does not represent a statistical problem but one which depends upon the purposes to be served by the economic analysis. We have chosen two alternative composites, (1) a base year composite of production and (2) the current year's composite of production. Two sets of formulas therefore had to be developed for measuring production, productivity, and unit labor requirements; one using base year weights and the other current year weights. Then on the basis of the two questions posed above and the criterion that $L = M/Q$, the following alternative sets of formulas were derived:[5]

		Base year production composite		Current year production composite
Unit labor requirements	(1)	$\frac{\sum l_i q_0}{\sum l_0 q_0}$	(2)	$\frac{\sum l_i q_i}{\sum l_0 q_i}$
Productivity	(3)	$\frac{\sum l_0 q_0}{\sum l_i q_0}$	(4)	$\frac{\sum l_0 q_i}{\sum l_i q_i}$

In order to construct production measures suitable for the computation

[5] The derivation of these formulas and the discussion of their meaning will be found in the introduction to a forthcoming report of the National Research Project—Production, Employment and Productivity in Manufacturing Industries, 1919–36.

of the above measures for the base year and current year composites formulas (5) and (6) would have to be applied.

Production (5) $\frac{\sum q_i l_i}{\sum q_0 l_i}$ (6) $\frac{\sum q_i l_0}{\sum q_0 l_0}$

q represents the quantities of each product produced, l the unit labor requirements, which is the ratio of man-hours utilized to the quantities produced; and the subscripts 0 and i designate base year and current year respectively.

The selection of the composite to be used depends upon the characteristics of the period under consideration. Thus the use of a base year composite has greater value under relatively stable conditions of production. In general, the use of a base year composite has more significance when dealing with relatively short periods of time. There are, however, certain times when the use of a base year composite may nevertheless be significant even in periods characterized by shifts in the composition of production. For instance, we are interested in the answer to the question, How much labor would be required if we again attained the 1929 volume and composition of production? Aware of the changed importance of the consumers goods and capital goods sections, one may yet assume that when 1929 volumes of production are again attained the composition of production would revert to one similar to that of 1929. Such an assumption would then permit the construction of measures using the 1929 production composite as a system of fixed weights. Should, however, analysis of present conditions indicate that the composition of production today is likely to be typical of the future, then the questions would have to be formulated in terms of the 1938 composition of production, or in terms of a changing composition of production. When the changing composition of production is in a definable direction, not random, then the question put in terms of the current year composite is a more fruitful one.

Since the composition of production is always changing, the question is: How does one determine whether a changing composition of production is significant from the standpoint of measuring productivity? When both measures are constructed, one using a base year composite and the other a current year composite, the difference between the two results constitutes a measure of the effect of changing composition of production and can be used as a guide.[6]

[6] The differences in the results obtained by two such measures and the effect of correlation between the weights and relatives have often been analyzed in index number literature with reference to price indexes and value-weighted production indexes. See, for instance, Staehle, *International Comparisons of Cost of Living* (International Labor Office, 1934); L. von Bortkiewicz, "Die Kaufkraft des Geldes und ihre Messung," *Nordic Statistical Journal*, Vol. 4 (1932), parts 1–2, pp. 1–68; Lewis, *op. cit.*, pp. 292–293; Warren M. Persons, *The Construction of Index Numbers* (Harvard Economic Society, Inc., 1928), pp. 33–36.

The differences between the results of the two alternative measures are most pronounced when there is a distinct correlation in the relative changes of production and productivity of the individual products. For instance, should productivity increase more rapidly for those products which show a more rapid rise in production, the productivity index with reference to the current year composite will be higher than the index referring to the base year composite. This is illustrated in Table 2. Using Dr. Mills' indexes of output per wage earner for 32 manufacturing industries from 1899 to 1914, we have constructed two composites—one with 1899 and the other with current year employment weights. The important differences between the two indexes occur in the years 1909 and 1914, and are due to the rapid changes in the

TABLE 2

COMPOSITE INDEXES OF OUTPUT PER WAGE EARNER FOR 32 MANUFACTURING INDUSTRIES, 1899–1914*

(1899 = 100)

Year	Index of output per wage earner with	
	Base year employment weights	Current year employment weights
1899	100.0	100.0
1904	104.1	105.4
1909	103.5	110.0
1914	111.7	127.9

* The composite indexes were derived from the indexes of output per wage earner for individual industries presented by Frederick C. Mills in *Economic Tendencies in the United States* (New York: National Bureau of Economic Research, 1932), p. 33. Mills presents data for 35 industries. For three of these, however, index numbers are not shown for each of the census years in the 1899–1914 period; all computations, therefore, are based upon data for 32 industries only. Corresponding wage earner figures, which were used as weights, are from the *Census of Manufactures*.

structure of the manufacturing economy. The difference in 1914 reflects to a large extent the rapid growth of the Automobiles industry since 1909. This can be readily seen when the Automobiles industry is excluded from the composite indexes (see Table 3). Since the Automobiles industry was insignificant in 1899 (0.1 per cent of total employment of the industries covered by Mills' composite) and this index presents relative changes in the productivity for the production schedule of 1899, it does not reflect the effect of the growth and rapidly increasing productivity of the Automobiles industry. On the other hand, when the Automobiles industry was given its changing relative weight each year in the index with current year weights, this index reflected the effect of its rapidly rising productivity in 1914, the year in which the Automobiles industry assumed importance. Even when the Automobiles industry is excluded we notice that there is still a consid-

erable difference between the results obtained by the two formulas for the years 1909 and 1914. These differences result from the fact that production increased most rapidly in those industries which had the highest rates of productivity increase.

TABLE 3

COMPOSITE INDEXES OF OUTPUT PER WAGE EARNER FOR 31 MANUFACTURING INDUSTRIES (AUTOMOBILES EXCLUDED), 1899–1914*

(1899=100)

Year	Index of output per wage earner with	
	Base year employment weights	Current year employment weights
1899	100.0	100.0
1904	104.1	105.4
1909	103.5	110.0
1914	111.6	118.8

* Based on same data as Table 2, with the Automobiles industry excluded.

TABLE 4

COMPOSITE INDEXES OF OUTPUT PER MAN-HOUR FOR 59 MANUFACTURING INDUSTRIES, 1919–36*

(1929=100)

Year	Base year production composite	Current year production composite
1919	63.5	69.1
1920	67.3	72.3
1921	71.7	77.4
1922	77.2	80.3
1923	81.3	82.9
1924	84.0	85.7
1925	88.4	89.4
1926	91.4	92.0
1927	92.5	93.3
1928	97.0	97.3
1929	100.0	100.0
1930	100.9	101.1
1931	104.1	106.1
1932	103.1	107.5
1933	107.6	113.4
1934	110.8	113.7
1935	118.3	122.2
1936	121.6	123.9

* Based on preliminary indexes of output per man-hour for 59 manufacturing industries. The indexes upon which this composite is based will be presented in a forthcoming report of the National Research Project—*Production, Employment and Productivity in Manufacturing Industries, 1919–36.*

This can be illustrated further with reference to the period 1919–36, for which we, on the National Research Project, have constructed indexes of production and productivity for 59 different manufacturing industries. These have been combined into two indexes, one using 1929 and the other current year man-hour weights. (See Table 4.) The differences in the results obtained by using the two indexes are relatively minor, but the character of the divergence is instructive. For the period 1919–29 we note that the productivity for the 1929 production schedule increases more rapidly than that for the current year production composite. The reason is that productivity increased more rapidly in those industries where production increased more rapidly. However, the production increases in these industries have not been large enough to result in as wide a divergence as for the period 1899–1914. From 1929 to 1936 it is interesting to note that the direction of the differences is reversed. During this period the capital goods and durable goods industries declined more precipitously than did the non-durable consumption goods industries. It is also in the durable goods industries that declines in productivity during the period of falling production are found more frequently than in the non-durable goods industries. As a matter of fact, in most of the consumption goods industries, the output per man-hour increased even during the years of declining production after 1929, and when production began to rise the productivity of the non-durable consumption goods industries increased more rapidly. The index constructed with current year weights, which reflects these changes in the composition of production, therefore shows a greater increase in productivity than the index using the base year (1929) weights.[7]

The value of using both formulas together lies in the fact that while each measure answers a different, specific question, together they give added significance to the analysis of productivity changes because they reflect the magnitude of the differences resulting from the changing composition of production. It might be suggested that a "compromise" formula, for instance a geometric average of the two formulas, could have overcome the seeming paradox of two different measures describing what appears to be the same concept. Such a "compromise" formula has been avoided, however, for a definite reason. The position taken here is that there is no "true" measure of productivity or produc-

[7] In using the data on productivity for the purpose of estimating future labor requirements, it is of course important not to compare the figure for one year simply with that of any other single year, but to interpret the annual data in the light of the historical trend. In doing so it is possible to take into account the effect of such factors as percentage utilization of capacity, the survival of the most efficient and the mortality of the least efficient plants on the productivity changes for a given period. This is particularly important in periods characterized by wide fluctuations in production.

tion for a group of diverse products; that measures of production and productivity should therefore not be considered "approximations" to an ideal "reality;" and that a clear understanding of the specific purposes for which they are to be used and of the questions that are being answered must dictate the method used to construct them. The more clearly the purposes and the meaning of these measures are understood, the more valuable they are.

Had the basic purposes of measuring production and productivity been directed to other ends, the formulas discussed here would, of course, not be relevant. For instance, if it were desired to utilize the entire labor supply and to distribute this man-power in production activities according to a defined scheme of economic development, say the achievement of a steadily increasing standard of living, then the significant measure of labor would be not the aggregate of undifferentiated labor as used by us, but a distribution of available man-power by industry, occupation, skill, location, mobility, etc. Furthermore, since the selection of different types of productive activity and the allocation of economic resources would be determined by the requirements of the given purpose, namely, increasing the standard of living, the criteria for measuring the relative importance of diverse types of products would also be determined in terms of that given social objective. The question, What volumes of production are obtainable with a given labor supply?, though superficially analogous to our former question, could not be answered for this particular purpose either by the measures designed by us or by any other production or productivity index commonly used. The problem with which we were confronted arose from an already existing allocation of human and natural resources which was determined through the operations of the market. The criteria for comparing the relative significance of diverse products under such conditions were thus dictated by the existing methods of labor utilization and the existing patterns of production, and were defined in accordance with the specific purpose of our analysis.

THE MEASUREMENT OF THE TECHNOLOGICAL FACTOR IN LABOR PRODUCTIVITY*

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My thesis is threefold: First, measurement of the rise or fall of labor productivity between two given dates does not necessarily measure the pressure of technological changes upon the potential volume of employment. Second, computations of labor productivity from the employment and production data of a given year are far from a sure guide in estimating the possible sum of employment opportunities. Third, it would be useful to redefine the problem of measuring the reemployment potential of particular industries in terms of the postulate of capacity operations.

No questions will be raised here which strike to the logical foundations of the attempt to measure labor productivity and technological unemployment by statistical methods. It will be assumed, instead: First, that the sum of employment and the quantum of production can both be truly measured, at least with reference to given industries at given dates. Second, that the resulting computations of man-hour output or of unit labor requirements are statistically valid. Third, that some part of the total unemployment of a given industry at a given date is attributable to technological factors. Fourth, that such technological factors include the nature of industrial techniques as well as the nature of industrial facilities.

Studies of labor productivity may take any one of at least three distinct forms; they may be based on computations which relate to the national economy as a whole—e.g., the overall studies of Messrs. Weintraub and Posner—to individual segments thereof—e.g., the industrial studies of Mr. Bowden;—to individual producing units—e.g., the plant studies of Mr. Stern. In the present discussion I propose to consider none but studies of individual industries—railroad transport, textile manufacture, iron and steel works, cigar manufacturing, coal or iron mining, etc. This is not to deny the significance or value of studies of labor productivity which relate to the total national economy or to individual producing units; it is merely to recognize that the overall and plant studies raise special analytical problems which are not of present concern. To grapple with the overall studies, for example, would necessitate weighing the validity of the assumption

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that the quantum of the national income (goods plus services) is significantly measurable at any one time or that its magnitude (expressed in value) is significantly comparable between any two dates. To reckon with the plant studies, once again, would necessitate an appraisal of how far the labor requirements of a single plant (actual or ideal) might be held to be fairly representative of the labor requirements of an industry as a whole.

Nor is the present discussion concerned with the whole range of implications that might follow from statistical determinations that labor productivity within a given industry had changed by so much in level between two dates or held at this or that level at any one date. Instead, its exclusive concern is with those implications which bear upon the capacity of an industry, as limited by technological factors, to absorb in gainful employment the whole of the labor force which is ordinarily attached to it.

In the statistical measurement of labor productivity for a given industry at a given date, two sets of data are put to use; first, data on volume of employment as expressed in man-years, man-weeks, man-days, or best of all man-hours of labor; second, data on volume of production as expressed in tons, pounds, yards, or other physical units of output. By simple division, labor productivity is then computed as a ratio of employment to production or of production to employment; e.g., volume of output per man-hour; labor requirements per unit of output.

If, therefore, labor productivity is measured as rising or falling between any two dates chosen for comparison, the explanation must be sought in the whole series of influences which might have been operative, within this period, upon the volume of employment, upon the volume of production or upon both together. If, again, labor productivity computes out to a certain value for any given date, that has to be understood as the outcome of the many forces which might have been working upon the sum of output no less than upon the sum of man-hours. We should be careful, therefore, not to equate every rise or fall of labor productivity with the operation of some factor of technological change and not to estimate the employment opportunities of the short-run future from nothing more than the levels of labor productivity as recorded in the here and now.

In fact, there is an endless variety of influences which may enter into the determination of labor productivity. I therefore propose to consider some of the many factors which are individually capable of acting upon the volume of employment, upon the volume of produc-

tion, or upon both together. This list of factors is long; the inter-relationships between individual factors most complex; the difficulties of correlation, multifold and stubborn. Merely to state the problem, I consider, is to raise serious doubts as to the inherent significance of statistical comparisons of labor productivity through time. It raises particularly serious doubts, in my opinion, as to the feasibility of using recorded changes of labor productivity as a measure of technological unemployment, or of employing computed levels of labor productivity as a measure of the possible sum of industrial reemployment.

First, it is certain that the level of man-hours output is partially determined, at any and all times, by the operation of technological factors as the term is commonly used. Among such technological factors, it would be useful to distinguish individually: (a) the replacement of hand processes by machine processes (thus ring spindles for mule spindles in cotton manufacture; mechanical cutting and loading of coal for hand cutting and loading, etc.); (b) the improvement of plant and equipment so that it carries a heavier load of service for a given expenditure of machine time (thus the enlargement of blast furnaces, the greater tractive capacity of locomotives); (c) the forcing of heavier work-loads upon workers for equal or shorter hours of labor (e.g., the so-called "stretchout" problem of the textile manufacturing industry); (d) the speeding-up of the pace of machine service and of labor effort (as in automobile manufacturing during recent years); (e) the substitution of a single belt-line process for many discontinuous processes (as in the integration of blast furnaces with iron and steel works and in the development of continuous rolling operations); (f) the subdivision and specialization of labor, generally as part of the shift from handicraftmanship to mechanical techniques (as in the change from hand-made to machine-made cigars).

It would be superfluous to dwell at length on these technological factors; they make up a complex of mechanization and rationalization of which any number of examples could be cited from the studies of the B. L. S. and of the National Research Project. But if the technological factor is a genuine determinant of the level of labor productivity, and of recorded changes therein, it is by no means the only determinant. True, the technological factor of labor productivity may be regarded as more or less permanent, while the other factors are all more or less transient in that they arise out of cyclical fluctuations of productive activity, temporary variations in the character of demand, managerial decisions on operating policy that may later be modified, etc. On the

other hand, the short-run we always have with us, in economic statistics as elsewhere. Because the figures with which the statistical economist must deal reflect the compound interactions of the transient with the permanent, his techniques of analysis must give weight both to the short-run and the long-run.

The rate of activity at which a particular industry is operating—e.g., 25, 50, 60 or 100 per cent of capacity—would seem to be the most important of the non-technological determinants of labor productivity. I shall not undertake here to surmise whether and how far, in any given industry and for any given amplitude of cyclical fluctuations, man-hour output ought to vary directly or inversely with the rate of productive activity. What I do want to stress is that the computed man-hour output for any year must be largely a function of the volume of output in that year; and must be so for at least three reasons: First, because of the presence of an important constant—the overhead factor—is the number of man-hours necessary to obtain a given amount of output. Second, because of the greater or lesser selectivity (age, skill, experience, etc.) with which the labor force may be chosen as total employment contracts or expands. Third, because of the varying share of production which may be contributed at the several cyclical phases, by the plants lying closest to the margins of efficiency, and by the equipment lying closest to the same margins in particular plants.

Whatever the net result of these influences upon a particular industry over a particular period, three conclusions seem to me inevitable: First, the most meaningful comparisons of labor productivity are those which relate to each of two years of capacity or near-capacity operations, say 1928–29 and 1936–37 for the purposes of iron and steel, automobile manufacturing, cotton textiles, etc. Second, labor productivity should not be compared for dates between which the level of productive activity varied significantly, say 1928–29 or 1936–37 with 1931–32, unless it proves practicable to make adjustments for variations of level of output. Third, the aim of the statistician should be to work up schedules that show how labor productivity, in a given industry at a given time, varies at all significant levels of the rate of operations. I have in mind, as a rough example, the studies of the B. L. S. on iron and steel works.

A second major determinant of labor productivity is the variable share of total employment which may be devoted to the work of maintenance and repairs in the course of a given year. Man-hours so expended are indispensable, of course, if total capacity is to be preserved and if labor and machine efficiency is to be kept intact; but over short

periods, in any event, they may distort the ratio of man-hours to output. If the proportion of man-hours on maintenance and repairs varied regularly through time, or if the variations were small and haphazard, it might be a defensible procedure to neglect this factor. But the facts would seem to be that in many if not most industries, there occur huge annual fluctuations from time to time in the weight given to maintenance and repairs; this is largely a consequence of the intertwining of corporate finances with cyclical upsurges or downswings of productive activity.

As one very striking example, I would refer to the railroad industry in the United States. The fluctuations of the factor of maintenance and repairs are here so large, from one cyclical phase to the next, as to enshroud in deep ambiguity the significance of estimates of labor productivity based on traffic-units alone as the measure of total output. Whether and how far it would be feasible, for railroad transport and other industries, to redefine output so as to make allowance for maintenance and repairs, I am not prepared to say. Nevertheless, it seems to me that procedures of this kind should be developed to guard against the likelihood of serious distortion in the computation of labor productivity.

Still a third determinant of labor productivity arises out of, and is directly related to, the question of maintenance and repairs. I have in mind what might be called the average age or the average obsoleteness of the plant and equipment of a particular industry. Thanks again to the intertwining of corporate financing with the business cycle, it is the general rule that the overhauling of productive facilities tends to be carried out in spasms or rushes. For quite a while after the burst of overhauling has taken place, labor productivity will tend to settle at higher levels than would otherwise be the case; not only because the new equipment may be technologically superior to the old, but also because the new equipment, simply because it is new, will stand in little need of maintenance and repairs for some time to come. But after the equipment has been used for a certain time, the increased need for maintenance must tend to depress the level of labor productivity.

If, therefore, it would be mistaken to calculate the pressure of technological change from levels of man-hour output that gave undue weight to cyclical swings of expenditure on maintenance and repairs, it must be equally mistaken to calculate reemployment possibilities from levels of man-hour output on the assumption that existing plant and equipment will maintain its full efficiency with growing average age. How to correct for this variable of average age or how to distin-

guish it clearly from cyclical fluctuations of maintenance and repairs, I am not prepared to say; but that statistical adjustments are called for on its account seem to me reasonably clear.

Because of limited time, I shall merely enumerate some of the other factors that tell against the assumption of changing levels of labor productivity as an outcome of technological developments alone and that warn us to beware of making uncritical use of the labor productivity of the here and now as a measure of the reemployment possibilities of a particular industry. First, in certain industries (e.g., the mining of iron ore) there exist two totally different techniques of obtaining the same product; one technique with smaller labor requirements (strip mines) and the other with larger labor requirements (underground workings). From year to year, as well as at different levels of output for any one year, the distribution of total output between these techniques may vary significantly. Second, in almost all industries, variations in the quality of output may give rise to significant variations in the labor requirements per unit. Not to speak of such infinitely complex cases as the manufacture of automobiles, I would remind you of the relatively simple case of the spinning of cotton where the labor requirements are significantly dependent upon the count of yarn being spun. Third, labor productivity is also susceptible to variations in the quality of input. When smelting ores, for example, the tenor of the ore fed to the smelters will exert some influence, probably small but genuine, on the man-hour output of the workers. Fourth, in all industries producing a heterogeneity of products, the levels of labor productivity are significantly dependent upon the composition of the total output. Thus in the case of rolling mills, iron and steel, the sum total of employment possibilities would tend to be conditioned by the distribution of output among rails, sheets, tubes, wire, etc. Fifth, there is always the question of the shifting coverage of the statistical definition of a particular industry as reported at two different dates. In automobile manufacturing, for example, the statistical coverage may widen or narrow with reference to the treatment of affiliated iron and steel works, of plants supplying parts, of shops supplying machine tools, etc. Finally, there are the special problems which arise out of the extent to which the hours of labor actually in force at any given date approximate to or diverge from optimal hours of work.

In view of the complex variety of the factors at work, it might be well, I venture to suggest, if statistical economists gave up the attempt to distinguish the specific influence of technological change from that of the other determinants of labor productivity. Even if the problem

could be solved, it is doubtful what value the results would have in enabling us to cope with unemployment. To say that technological change is one of the causes of unemployment is either to suppose that existing employment would expand by so much if the technological progress of the past were undone up to given limits or else to predict that existing unemployment will rise to a particular level if technological progress continues at a given rate. The former approach is evidently sterile; the value of the latter depends largely on the gift of prophecy. In any event, it seems to me that statistical economists might be well advised to abstain from trying to measure technological unemployment by the over-simple procedure of computing changes in labor productivity on the basis of recorded changes in total production and total employment. If these measurements are to be made at all, they should be made with close and elaborate adjustments for all of the factors at work: rates of productive activity, maintenance and repairs, operating variables of all kinds.

I am far from arguing that all is futility in the attempt to measure the ability of particular industries to reemploy labor. It seems to me, however, that starting from the coexistence of idle men with idle machines, the aim should be to measure the possible sum of employment when the plant and equipment of an industry was running full blast with enough weight given to maintenance and repairs to preserve that capacity intact. Instead of seeking to evaluate the force with which machines may have unmade jobs for men in the past, it is much more meaningful, I would urge, to evaluate the present power of machines, running at full capacity, to absorb workers into gainful employment.

An approach such as this would require the continuing measurement, year after year, of the employment potential at capacity operating rates for particular industries. It would mean the constant revision of all past estimates in response to continuing changes in technology, in labor markets, in consumer preference, etc. This approach involves questions for the economist: At what level of output shall an industry be regarded as operating at full capacity? It involves questions for the engineer: What is the proper quota for the maintenance at capacity levels of output? It involves questions for the statistician: What variations of labor productivity go with what variations of level of output? Admittedly, these questions are obscure and complex. But they must and should be faced if one great end of national economic policy—full employment of labor—is to be studied jointly with another great end—the optimum exploitation of productive resources.

DID PRODUCTIVITY INCREASE IN THE TWENTIES?*

By Elmer C. Bratt
Lehigh University

In common with most types of statistical measurement, productivity has importance from several points of view. Its analysis is of concern in (1) studying employment opportunities; (2) the broadened scope of labor administration; (3) making the proper provision for the needs of growth; and (4) understanding the possibilities of achievement of adjustment between various economic processes. Possibly there are other uses for a measure of productivity.

One should therefore guard against broad generalizations based on measurements developed for a specific purpose. A measure of productivity developed by Mr. Weintraub[1] will be given particular consideration in the present paper. This measurement considers as workers only those who are contractually employed by others, excluding the self-employed. Productivity is obtained by dividing total output by the amount of labor of contractually employed workers. The resulting measurement may have significance from the first of the four points of view listed above, that of studying employment opportunities, but has little from any of the other three. For most purposes the work of the self-employed must be counted as a part of the total work applied.

Mr. Weintraub's measurement of productivity indicates a marked increase from 1920 to 1922. There appears to be common agreement that the productivity of total industry was showing increases at this time. For the period 1922 to 1929, the measurement shows a level movement, the figures in 1922 and 1929 being equal. That this result is importantly related to the use of labor employed by others only is evident from the results shown by a collateral measurement computed by Mr. Weintraub. This measurement is computed by use of figures on both the contractually employed and self-employed. Tabular results are not given, but a rough reading from the chart indicates an increase in productivity of approximately 10 per cent from 1922 to 1929.[2] A more rapid increase was taking place in the number of self-employed than in the number of contractually employed.

At the very outset, therefore, we can provide a tentative answer to the question proposed. Except for a very narrow interpretation of the

* A paper presented at the One-hundredth Annual Meeting of the American Statistical Association, Detroit, Michigan, December 29, 1938.

[1] David Weintraub, "Unemployment and Increasing Productivity," published in National Resources Committee *Technological Trends and National Policy*, June, 1937, pp. 67–87.

[2] *Op. cit.*, figure 3B, page 73.

problem it appears that productivity increases did occur throughout the twenties. This is further corroborated by the fact that Mr. Weintraub uses labor-time in terms of the prevailing work week as his divisor, while the length of the work week was declining in the twenties. The use of constant man-hours would have resulted in a measurement showing more rapid increases in productivity. The prevailing work week may be more representative, however.

In spite of these facts, increasing attention is directed to a "productivity plateau" in the twenties and to the putative reasons therefor. It is the ideas so implied which I wish to consider. The problem centers around productivity in the service industries, for which no measurements are available. Yet when a measurement of the productivity of total industry is attempted, the measurability of the component elements is implied.

Measurements of changes in the productivity of manufacturing industries are well known and fairly representative. In a recent study for manufacturing industries from 1923 to 1929, F. C. Mills shows an increase in productivity per wage earner of 22 per cent, and per employee including salary workers of 23 per cent.[3] The error involved in measurements for these industries arises in the difficulty of making allowance for embodied labor, for part time, for quality changes in the product, and for dissimilarity in the classification of production and employment.

Professor Mills' computation of output is derived from indexes of production. This has proven practicable in those industries in which a physical product is made and in some of those whose function is to handle commodities. For most others, which may be broadly termed service industries, no such method is available. According to Professor Kuznets' estimates, roughly 40 per cent of the national income is derived from commodity-producing industries, 20 per cent is derived from commodity-handling industries, and 40 per cent is derived from service industries.[4]

National income estimates comprise the only available data to use as the numerator in attempting to measure over-all changes in productivity. For this purpose, however, marked limitations are involved. Three considerations stand out: (1) the estimates of long-period growth implied are very inaccurate; (2) no reasonably accurate deflator to remove the price element is available; (3) special difficulties are met with in estimating the value of the net product in service industries.

[3] F. C. Mills, "Employment Opportunities in Manufacturing Industries," National Bureau of Economic Research Bulletin 70, September 25, 1938.

[4] Simon Kuznets, *National Income and Capital Formation, 1919–1935* (National Bureau of Economic Research, 1937), pp. 20–22.

INACCURACY OF NATIONAL INCOME IN MEASURING LONG-PERIOD CHANGE

National income aggregates must be based on figures drawn from many sources and of different degrees of reliability. To quote the *Federal Chart Book*, "figures for years preceding 1929 are based on less complete and less satisfactory data than those available for years since 1929."[5] Uncertainty as to the comparability of national income in the early and late twenties makes estimates of productivity derived unreliable. This fact can be illustrated by comparing different estimates of national income. The one used by Mr. Weintraub was computed by the Brookings Institution, making liberal use of National Bureau of Economic Research estimates then available.[6] This estimate shows an increase in national monetary income of 24 per cent from 1920 to 1929. If the productivity computation were being made today, a more recent estimate of national income, sponsored by the National Bureau, might well be used. The recent figures show an increase in national monetary income of but 15 per cent from 1920 to 1929.[7] The increase in productivity from 1920 to 1922 would appear to be markedly less than that shown by Mr. Weintraub. While the difference between the Brookings Institution and the most recent National Bureau figures from 1922 or 1923 to 1929 is minor, we cannot be sure a future revision will not change these relative levels somewhat as the 1920 to 1929 relative difference was revised.

INAVAILABILITY OF AN ACCURATE PRICE DEFLATOR

Mr. Weintraub used a very crude deflator developed by Professor Kuznets. It consists of the combination of the B.L.S. Cost of Living Index with a weight of 9 and an index of the cost of capital goods with a weight of 1. This does not provide an adequate deflator for the various elements of national income, and it cannot be considered a reliable

[5] *The Federal Chart Book*, prepared by the staffs of the Central Statistical Board and National Resources Committee, January, 1938, p. 2. In *National Income and Its Elements* (National Industrial Conference Board, 1936), p. 96, R. F. Martin estimates the "approximate margin of error" of the various parts of the national income estimate. Weighting the arithmetic mean of the approximate margin-of-error figures given in each category by the percentage of total income involved, and assuming 20 per cent as the margin-of-error estimate for the 10 per cent of the national income for which no estimate is given (dubbed an "informed guess"), a 5.5 per cent margin of error is obtained for the total. To what statistically computed measure the margin of error so estimated is analogous, Martin does not say. Possibly it should be considered to correspond more closely to the P.E. than to the σ range. An estimate of business savings is not included in the National Industrial Conference Board figure; if included the margin of error would have to be increased somewhat.

[6] M. Leven et al., *America's Capacity to Consume* (Brookings Institution, 1934), pp. 152–153.

[7] See Simon Kuznets, "National Income, 1919–1935," National Bureau of Economic Research Bulletin 66, September 22, 1937, p. 2, and Simon Kuznets, *National Income and Capital Formation 1919–1935* (National Bureau of Economic Research, 1937), p. 8. Minor revisions were made in the amounts between the time of publication of the two estimates shown in these sources.

deflator for the total. The extent to which it is inadequate for certain industries has been vividly portrayed by Professor Kuznets. He shows, for instance, that, while the physical volume of agricultural output was approximately the same in 1920 and 1934, the agricultural income component deflated by the Index of Finished Goods Prices, described above, was approximately halved between the two dates.[8] Theoretically it is of course proper to hold that the discrepancies would cancel out in the total. Actually this is quite unlikely since the B.L.S. Cost of Living Index purports to measure only the prices paid by wage earners and low-salaried workers, and, for various well-known reasons, does not measure these prices adequately.

SPECIAL DIFFICULTIES IN ESTIMATING VALUE OF NET PRODUCT IN SERVICE INDUSTRIES

Any currently obtainable measurement of the "total net product" of industry will comprise a hybrid total. It is an estimate of the amount of physical product in commodity-producing industries plus an estimate of the amount of service rendered in non-commodity-producing industries. This is a summation at two different stages. The end result of all economic effort is a service whether or not a physical commodity is first produced.

The use of national income as a representation of the total net product is an attempt to avoid this difficulty. Income is the only way we can measure output in most service industries,[9] while the results obtained from such measurements can be checked by indexes of production in the commodity industries. In employments such as professional, personal and domestic service, almost the entire income is paid out as compensation to employees.[10] When such income is divided by the rate of payment the result is the amount of employment. When it is divided by the price of the service the result is the amount of the product. There is no clear evidence that Kuznets' Index of the Price of Finished Goods represents the price of the service any better than the rate of payment. There are grounds for holding in such a case that the deflated measure represents changes in employment as closely as it represents changes in the quantity of the service. The chief difficulty involved in establishing whether or not this is true is that no inde-

[8] Simon Kuznets, "Income Originating in Nine Basic Industries, 1919–1934," *National Bureau of Economic Research Bulletin* 59, May 4, 1936.

[9] An exception may be noted in the case of the telephone industry. Here output is measured with some adequacy by the number of exchanges made.

[10] Kuznets estimates that, for the period 1919–34, income in the "service" industrial branch averaged eight and a quarter billion dollars yearly and that the compensation to employees comprised 98.4 per cent of the total. See *National Income and Capital Formation 1919–1935*, *op. cit.*, p. 30.

pendently computed measure of physical quantity is available for checking, such as exists in commodity industries.

THE DEFLATION PROBLEM CONSIDERED BY INDUSTRY CLASSIFICATION

The matter may be viewed from a slightly different angle. Referring to Table 1, it will be seen that for every one of the commodity industries listed in the first four rows there was an increase in the physical product from 1920 to 1929. The income deflated by the Index of the

TABLE 1

DEFLATED INCOME, PHYSICAL PRODUCT, AND GAINFUL WORKERS, 1929*

(1920 = 100)

Industry	Deflated income	Physical product	Gainful workers†
1. Agriculture	95	111	97
2. Mining	89	141	91
3. Manufacturing	117	141	111
4. Construction	161	186	
5. Light, Power, Gas	371	212	—
6. Railroads	114	101	92
7. Communication	229	185§	—
8. Trade	113	—	144
9. Finance	190	—	—
10. Government	143	—	—
11. Service	188	—	—

* The income figures were taken from Simon Kuznets, "National Income, 1919–1935," *National Bureau of Economic Research Bulletin* 66, September 27, 1937, p. 5. The deflator used was Kuznets' Index of the Price of Finished Goods, described in the text. The measures of changes in the physical product were taken from Simon Kuznets, "Income Originating in Nine Basic Industries, 1919–1934," *National Bureau of Economic Research Bulletin* 59, May 4, 1936, p. 24. The measures of changes in numbers of gainful workers were taken from R. G. Hurlin and M. B. Givens, "Shifting Occupational Patterns," *Recent Social Trends* (McGraw-Hill, 1933), p. 281.

† The gainful workers category is defined as those regularly employed in an industry rather than as those actually employed. The figures refer to the 1930 Census but probably are fairly representative of the employment condition in 1929.

§ Represents the weighted average of telephone exchange and toll connections only.

Price of Finished Goods, on the other hand, shows either a decline or a much smaller increase. If, when applied to the total income, the Finished Goods deflator is to yield a measure of physical product, it is clear that the deflated income must show a much greater increase than physical output in the non-commodity industries. Actually this result is indicated by the comparison shown for the three industries represented in the 5th to the 7th rows of the table. These three industries accounted for less than 9 per cent of the total income in 1929, however, as compared to the four commodity industries which ac-

counted for 38 per cent. A substantially higher increase in deflated income than physical output must, on the average, have occurred in the industries represented in the last seven rows of the table if deflation of the total national income represents physical product. If we assume this to be true, an interesting conclusion appears to follow. Mr. Weintraub produces figures to show that "man-years of employment in service industries" increased by 46 per cent from 1920 to 1929.[11] The increase in deflated national income for all industries except the first four listed in Table 1 was 48 per cent between the same years. This group is not precisely comparable to those Mr. Weintraub describes as service industries, but it is interesting that the increases are almost the same. Since, if the deflator is at all adequate, the increase in physical output for the group considered must be much less than the increase in deflated income, it appears to follow that decreasing productivity was experienced in service industries.

Breaking down the deflated national incone into industrial classifications appears to indicate that the use of income figures to represent the over-all change in productivity assumes a level or declining productivity for service industries. This might account for the tendency of the productivity measurement to show a plateau. There is no real evidence to indicate declining productivity in the service industries, however.

LEVEL AND CHANGE OF PRODUCTIVITY IN THE SERVICE INDUSTRIES

A productivity measurement could not show a plateau because of the difference in level of productivity in different industries.[12] Productivity simply cannot be quantitatively compared between industries producing non-comparable products.[13] Quantitative results cannot be attributed to unmeasurable quantitative influences in this case.

A larger proportion of the income appears to be saved or paid out to owners in basic industry than in service industry. It is untenable to interpret this to mean a higher absolute level of productivity in basic industry. Savings are used to employ people in capital industries, and very often in the same industries in which they are made.[14] The adding of savings in national income estimates may, indeed, result in an overstatement of productivity when national income figures are used in the computation. The savings do not increase the output; if prices had

[11] His figure for the increase in "man-years of employment in the basic industries" for the same period is 3 per cent. See *op. cit.*, pp. 74–75.

[12] This is the fundamental reason Mr. Weintraub assigns for the plateau. See *op. cit.*, p. 75.

[13] Some hold that further productivity increases are much more plausible in service than in manufacturing industries. Likely further changes do not determine present levels.

[14] The fact that savings may be used to employ people in other industries does not mean that those industries making the savings effect a greater contribution toward employment than they would if nothing were saved. At times, an even greater contribution might result from lowering prices.

been reduced so that no net savings occurred the computation would have yielded a lower productivity figure. This discloses a weakness in the use of national income figures for computing productivity, not a difference in the productivity of industries having a different amount of savings.

Some popular writers hold that increased ability to produce goods has been largely offset by difficulties involved in distributing the product. It is perhaps well to call attention to the fact that this differs from holding that there exists a lower level of productivity in service industries. Increased difficulty in distributing the product would appear rather to mean that productivity has declined in the service industries.

In conclusion, I would call attention to the present tendency to use estimates of national income in analyzing all types of economic change without reflecting to see whether or not such figures can well be used for the purpose in mind. I have shown one case where the use of national income figures is of doubtful value.

Even if a perfectly adequate measure of national income were available, there would be purposes for which an index of production would be more representative. This, I believe, is especially the case in studying growth or changes over a considerable period of time. For the present, it is perhaps better to forego a measurement of over-all growth or of over-all productivity than to use national income estimates in making the computation.

A REJOINDER

Mr. Bratt's principal objections to the method used to construct a measure of over-all productivity are: (1) the national income data are not accurate enough for the purpose, (2) there is no satisfactory deflator available, and (3) we still have no way of estimating the physical product of service industries.

The reader should know that all three limitations were pointed out and discussed by me in some detail (see pp. 68–69 of the National Resources Committee's report on *Technological Trends and National Policy*, Washington, D. C., June 1937). The very fact that the third point is true makes it necessary to use the national income data for the purpose of measuring the Nation's productivity unless it were thought wise to wait squeamishly for the attainment of perfection in the measurement of national income. The data used were the best then available (1936). Since then more refined statistics have been published and would of course be utilized if the circumstances required it.

I used the national income produced series as the numerator and aggregates of the several groups of income recipients as the denominator in computing the "productivity" measures.

There are many limitations to the use of the national income data for the purpose of measuring productivity. Some of the limitations were pointed

out in my article, Mr. Bratt points to others, and the reader can find still more under the heading "Uses and Abuses of the Estimates" in *National Income in the United States, 1929–35*, pp. 18–21; there he will also find the statement that "Subject to the limitations outlined above, the national income totals have considerable value as indicators of the productivity of the Nation and of the extent of the participation of all individuals in the end product of the economy." It is in this sense of the "productivity of the Nation" and not in the sense of the productivity of segments of the economy that the national income data were utilized.

It was not my purpose to measure productivity changes in each segment of the national economy. Indeed, it was pointed out that this was impossible with the material available. Had I been interested in constructing measures of productivity for a particular industry or for groups of industries, I should have proceeded differently. Not only do productivity measures have, as Mr. Bratt says, "importance from several points of view," but the measure must be so constructed as to meet the requirements of the specific purpose which it is to serve. In this connection the reader is referred to Mr. Magdoff's paper which appears elsewhere in this issue of the JOURNAL.[1]

The deflator used was designed to correct for changes in the purchasing power of the dollar—and only that. Though it may serve inperfectly even that limited purpose, it certainly must not be expected to serve any other purpose, least of all that of deflating the net monetary income ascribable to a particular segment of the economy and thereby to yield a measure of the segment's physical product. To approximate the latter each component of the national income would obviously have to be corrected for price changes of the goods and services produced in that component. Some of the statistical difficulties which would have to be overcome before a price index could be constructed that could be used to deflate the *net* monetary income of the several components of the national income, are discussed by Dr. Simon Kuznets in the National Bureau's *Bulletin* No. 59, pp. 4–6. I have mentioned some in my article. At any rate, the fact that a general purchasing power index yields absurd results when applied to individual components of the national income for the purpose of measuring physical output, has no bearing on the validity of using that index to correct the annual *totals* of the national income for changes in the dollar's purchasing power, nor on the use of the adjusted totals for the purpose of measuring changes in the Nation's output per person employed.

However, in the interpretation of the observed changes in the Nation's productivity during the period 1920–1935, some generalizations were made about the possible underlying movements. Permit me to quote a few of these generalizations before I return to Mr. Bratt's objections. " . . . the year-to-year fluctuations and the productivity plateau during the period from 1922 to 1929 also reflect the changing relative importance of the several fields of industrial activity and the different absolute levels of productivity characteristic of them." . . . "These figures should not be interpreted to mean that the increase in over-all productivity was the net result of rising productivity

[1] See p. 309.

in basic industries and stable or declining productivity in service industries, and that the productivity 'plateau' from 1922 to 1929 is therefore the result of increases in productivity in basic industries, offset by productivity declines in service. The fact is that, even if similar relative increases in productivity had occurred in both fields, a leveling off of the index of labor required per unit of output would have taken place if, during the same period, service activities had accounted for a rapidly growing proportion of the total output." " . . . over-all productivity ratios derived from the data on total national income and total employment cannot be interpreted as measures of the extent of technological advance in individual industries any more than per capita monetary national income figures can be used as measures of the incomes of individual groups in society. If the total national income is regarded as a changing composite of goods and services, however, these over-all productivity figures can be looked upon as measures of the changes in the relationship between total output and the size of the Nation's labor force employed in the creation of this composite . . . "

It is presumably with reference to the above statements that Mr. Bratt says that the observed productivity plateau could not be due to the difference in level of productivity in different industries because productivity "simply cannot be quantitatively compared between industries producing non-comparable products." My reference to comparative levels of productivity refers to the amount of labor required in the service and non-service industries to produce a unit of the Nation's output measured in terms of the national income produced. It seems to me that the point requires no elaboration that the nature of service activities is in general such that more labor is required to produce a dollar of net addition to the national income than in non-service activities. A growing importance of income derived from service industries would therefore have an effect on the Nation's level of productivity.

DAVID WEINTRAUB

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REPLY

Mr. Weintraub points to a critical issue when he states, "It seems to me that the point requires no elaboration that the nature of service activities is in general such that more labor is required to produce a dollar of net addition to the national income than in non-service activities." It does appear to need elaboration. A possible interpretation of the statement is that wage rates are lower in service industries, but I have no evidence that this is true, and, if true, I do not see that it would necessarily demonstrate that productivity is lower in service industries. A second possible interpretation is that savings are less in the service industries, but I have disposed of this argument above. If the meaning is that the nature of service employments is such that more labor is required from them to add a specified amount to the total physical product of society than is required from non-service employments, it is that productivity is lower in service employments by their very nature. Saying so does not prove it.

E. C. B.

RELIGIOUS DIFFERENTIALS IN THE NET REPRODUCTION RATE*

A. J. JAFFE

CONSIDERABLE information is available about differentials in the fertility rate in the United States and in numerous foreign countries.[1] Nevertheless, in two respects the field of fertility differentials in the United States needs further study: (a) in regard to possible religious differentials at any given time, and (b) in regard to possible trends in these religious differentials. It is the purpose here to attempt to study the net reproduction rates of Roman Catholic and Jewish stocks in this country, and trends in these rates.

Several studies have been made in an attempt to measure religious differentials in fertility,[2] and all of them have shown the Catholics to have higher fertility than the non-Catholics. However, of all these studies, only one, Stouffer's, made any attempt to hold constant the factors of age, urbanism, and economic status, three factors which are known to influence fertility greatly. With these three factors held constant, Stouffer found the Catholic birth rate to be higher than that of comparable non-Catholics, but he also found that the former fell much faster than the non-Catholic rate during the 1920's, and gave every evidence of soon overtaking the latter.

The results of this present study corroborate, in general, Stouffer's findings. Prior to 1930, Catholicism may have been a factor tending to raise the birth rate. The fertility of the Roman Catholics, however, appears to be decreasing rapidly, so that by 1930 their fertility appears to have closely approached that of the non-Catholics.

FERTILITY OF THE ROMAN CATHOLIC POPULATION

Great variations are found in the crude birth rates of the various Roman Catholic countries of Europe, suggesting either that the factor of Catholicism is not constant, or is relatively unimportant as an influence upon the birth rate, as compared to other social factors. For

* This article is an abstract of an A.M. Thesis, University of Chicago, 1938. The writer wishes to thank Dr. P. M. Hauser for the use of much unpublished birth statistics data for the city of Chicago.

[1] For a good summary article of available information in regard to differentials in the United States see P. K. Whelpton, "Geographic and Economic Differentials in Fertility," *Annals of the American Academy*, Vol. 188 (Nov., 1936), pp. 37–55.

[2] S. J. Holmes, "The Size of College Families," *Journal of Heredity*, Vol. 15, No. 10 (Oct. 1924), pp. 407–415.

W. S. Thompson, "Size of the Families from which College Students Come," this JOURNAL, Vol. 20, No. 152 (Dec. 1925), pp. 481–495.

S. A. Stouffer, "Trends in the Fertility of Catholics and non-Catholics," *American Journal of Sociology*, Vol. XLI, No. 2 (Sept. 1935), pp. 143–166.

G. K. Robinson, "The Catholic Birth-Rate: Further Facts and Implications," *American Journal of Sociology*, Vol. XLI, No. 6 (May, 1936), pp. 757–766.

the several Roman Catholic countries of Europe the average annual crude rates per 1000 population for the years 1926 to 1935 were as follows: Poland, 30.1; Spain, 28.3; Italy, 25.2; France, 17.3. In the United States the figure is 18.5[3]

Variations in the rates of different Roman Catholic stocks persist in the United States as will be shown, especially among the foreign born, even when some of the more important causes of variation, age distribution, economic status, and urban rural distribution are eliminated. Among the native born Catholic stocks of different national origins, however, these birth rate variations tend to become minimized.

Fertility of the foreign born Catholics: From United States Census of Population data and from the United States Birth Statistics Reports, it is possible to compute net reproduction rates for two foreign born Roman Catholic stocks living in the United States, the Italian and the Irish. From data for the city of Chicago it is possible to compute net reproduction rates for the Catholic Italian, and Polish, and for a group of miscellaneous Catholic stock.

By computing net reproduction rates as measures of fertility, the age compositions of the populations being studied are held constant automatically. Urban-rural distribution for the total number of Irish and Italians in this country is held approximately constant by the fact that they live almost exclusively in urban regions.[4]

In regard to economic status it is found that the median monthly rental of urban rented non-farm homes was about $37 for the Irish and $28 for the Italians in the United States. Hence, the Irish are, on the average, of a higher economic status than the Italians.[5]

In the analysis of the Chicago data the factor of urbanism is, of course, automatically held constant, since, by definition, all of Chicago is urban. Economic status was held constant by dividing the populations into census tracts in which the median rentals were under $30, and from $30 to $49.

The net reproduction rates for the selected foreign born groups are presented in Tables 1 and 2. From these data it cannot be seen definitely that the factor of Catholicism is very important. The Italians, for the entire country, have a net reproduction rate considerably above that for the foreign born as a whole and for all the foreign born excluding all the Irish and Italians (see Table 1). All the Irish, who are also

[3] A. J. Lotka, "Modern Trends in the Birth Rate," *Annals of the American Academy of Political and Social Science*, 188: 1–13.

[4] In 1930, 89 per cent of the former and 88 per cent of the latter lived in urban areas. The cities over 100,000 in population, contained 54 per cent of all the Irish and 59 per cent of all the Italian born. (*Fifteenth Census of the United States: 1930, Population*, Vol. II, chapter 5.)

[5] *Fifteenth Census of the United States: 1930.* Special report on "Foreign-Born White Families by Country of Birth of Head," U. S. Department of Commerce, Bureau of the Census, Table 8, page 15.

TABLE 1

NET REPRODUCTION RATES AND PERCENTAGE CHANGE (1920–1935) FOR SELECTED FOREIGN BORN WHITE STOCKS AND FOR TOTAL COUNTRY: UNITED STATES, 1920, 1925, 1930, 1935*

Stock	Net reproduction rates				Percentage change, 1920–35
	1920	1925	1930	1935	
Irish	1.08	.97	.94	.97	−10.2
Italian	2.52	2.16	1.62	1.03	−59.1
Total foreign born white	1.53	1.41	1.18	1.04	−32.0
Total foreign born white, excluding Irish and Italian	1.43	1.33	1.13	1.05	−26.6
Total United States†	1.17	1.13	1.08	.96	−17.9

* Rates for the years 1920, 1925, and 1930 apply to the 1930 birth registration area (excluding Maine). The rate for 1935 is for continental United States.

The population bases for computing the 1930 rates were obtained from the *Fifteenth Census of the United States: 1930, Population*, Vol. II, Chapter 10; and the special monograph, *Fifteenth Census of the United States: 1930, Age of the Foreign Born White Population by Country of Birth*. The population bases for computing the 1935 rates were obtained by aging the 1930 population 5 years according to the life table presented in *The Length of Life* (L. I. Dublin and A. J. Lotka, Ronald Press Co., New York, 1936). The age composition of the total foreign born white for 1920 was obtained from the *Fourteenth Census of the United States: 1920, Population*, Vol. II, Chapter 3; and that for 1925 by straight line interpolation between 1920 and 1930. The population bases for computing the rates of the Irish and Italians in 1925 were obtained by working backwards from the 1930 age distributions after making allowance for immigration between 1925 and 1930. The same procedure was used for obtaining the 1920 age distributions except that allowance was made for immigration between 1920 and 1930.

The numbers of female births by age of mother were obtained from the annual volumes of *Births, Stillbirths, and Infant Mortality Statistics*. For the years 1920 and 1925 adjustments were made for those states which were in the 1930 birth registration area but not in the 1920 or 1925 areas.

† Source: A. J. Lotka, "Modern Trends in the Birth Rate," *Annals of the American Academy of Political and Social Science*, Vol. 188 (Nov. 1936), pp. 1–14.

TABLE 2

NET REPRODUCTION RATES FOR SELECTED FOREIGN BORN WHITE STOCKS BY MEDIAN RENTALS: CHICAGO, 1930*

Stock	Median rental	
	Under $30	$30–$49
Italian	1.76	1.32
Polish	1.04	1.06
"Mixed"	1.01	1.06
Total foreign born white†	1.21	1.04
Total foreign born white excluding Italians and Polish	1.10	1.02

* Data for selected census tracts. The population distributions are obtained from E. W. Burgess and C. S. Newcomb, *Census Data of the City of Chicago, 1930*, Chicago, 1933, University of Chicago Press, Table I. The number of female births by age of mother are from an unpublished study by Dr. P. M. Hauser, in which all births were allocated to census tract of residence of mother. The average annual numbers of birth in the five year period, 1928–1932, were used.

† Source: P. M. Hauser, *Differential Fertility, Mortality and Net Reproduction in Chicago, 1930*, Ph.D. Thesis, University of Chicago, 1938.

mainly Roman Catholic, have a net reproduction rate, for the country as a whole, considerably below the average of the foreign born and of the entire United States population.

The trends in the net reproduction rates of the Irish and Italians are perhaps more significant than their respective rates as of 1930. Between 1920 and 1935 the rate of the Italians was cut more than half, whereas that of all the foreign born was cut about one-third, and that of the entire United States, about one-fifth. The Irish rate fell the least, about one-tenth. In 1920 the differences in the rates between the Irish, Italian, the total foreign born, and the total United States were large; by 1935 the rates of these four groups were almost equal.

Data are available for depicting the trend in the gross reproduction rate of the Italian born women since 1896. These rates are as follows: 1896, 3.68; 1920, 3.09; 1925, 2.44; 1930, 1.83; and 1935, 1.17. Between 1896 and 1935 the gross reproduction rate declined 68 per cent. Perhaps Catholicism was an important factor in the maintenance of a high reproductive rate in 1920 and prior years. By 1935, however, it appears to have become a relatively unimportant factor.

In Chicago, as of 1930, conclusive evidence of Catholicism as an important factor in the birth rate is also lacking (see Table 2). In both economic groups the foreign born Italians have rates higher than those of the total foreign born, whereas the foreign born Polish have rates well below the average of the total foreign born. The "mixed" group in this city, composed of a varied assortment of nationalities, has net reproduction rates very similar to those of the Polish.

These data suggest that the influence of the Roman Catholic religion upon the birth rate is rather negligible in comparison to such other factors as age, urban-rural residence, and economic status; in addition, there are probably other as yet unmeasured factors such as, perhaps, "rural mindedness," which are more important than religion. If data were available for all the foreign born nationality groups so that all the Catholics could be compared with all the non-Catholics, it might be found that the Catholic rate was the higher. Such data, however, are not available.[6]

A comparison of the net reproduction rates of the Italian and Irish in the United States in 1930 with certain selected groups is possible. The English, Welsh and Scotch combined, mostly non-Catholic, had a net reproduction rate of .80. The Scandinavians, who are also non-Catholic, had, on the other hand, a rate of 1.27. It should be noted, however, that only 63 per cent of these peoples lived in urban places

[6] For immigrants from such countries as Germany and Canada, which contain large numbers of both Catholics and non-Catholics, no subdivision by religion is possible. For immigrants from other Catholic countries, as France and Spain, birth registration data are not available. In regard to other countries, as Poland and Czechoslovakia, which were created after the war, it would appear that the number of births as reported cannot be related safely to the number of women as reported in the 1930 census. Hence, comparison is impossible between all the foreign born Catholics and non-Catholics.

in 1930, as compared with almost 90 per cent among the Italians and Irish. Thus, the factor of urbanism is not clearly eliminated.

The Germans, both Catholic and non-Catholic combined, had a net reproduction rate of .76. The Canadians, who similarly are composed of both religious elements, had a rate of 1.11. The Poles, composed of Jews and Catholics had a rate of .81, and the Russians, mostly Jewish, a rate of .93. As will be shown in the discussion of the Jewish rate, the Polish rate as here presented is probably underestimated, and the Russian overestimated.[7]

In summarizing these various rates, it should be noted that with the exception of the Scandinavians, a large proportion of whom are living in the rural regions, and the Canadians, half of whom may be Catholic,[8] the other nations which are all non-Catholic or mixed have consistently lower rates than have the Italian or Irish. The evidence, however, is at best but slightly suggestive that non-Catholic foreign born have lower fertility. The differences between nationalities are too great, and the factors of economic status and urbanization insufficiently held constant, to warrant a definitive statement.

Fertility of the native born Catholics: Net reproduction rates of the native born Roman Catholic population could be computed only for Chicago. Selected native born Italians and Catholic Poles and the native born of a group of "mixed" nationalities were analyzed and compared with the native whites of native parentage, who are mostly non-Catholic. Economic status is held approximately constant by comparing the several populations when all reside in areas of similar median rentals.

The results are summarized in Table 3.

TABLE 3

NET REPRODUCTION RATES FOR SELECTED NATIVE BORN WHITE STOCKS BY MEDIAN RENTALS: CHICAGO, 1930*

Stock	Median rental	
	Under $30	$30–$49
Italian	1.06	.81
Polish	.88	.73
"Mixed"	.95	.84
Total native born white†	.93	.78
Native white of native parentage§	—	.71

* See first footnote, Table 2.
† See second footnote, Table 2.
§ Median rental range of $40–$59.

[7] These net reproduction rates derived from data presented in Peter P. Klassen, "Specific Fertility Rates as Indices of Assimilation," A.M. Thesis, University of Chicago, 1938.

[8] About half of the population in Canada is Roman Catholic. See *Seventh Census of Canada, 1931*, Vol. II, page 506.

As in the case of the foreign born women, the factor of religion, or Catholicism in this case, does not appear to be of great importance. The net reproduction rate of the native born Italians is well above that of all the native born whites for the lowest economic group. The native born Polish and "mixed" nationalities, however, have rates about equal to or perhaps even lower than those of the other native born for this economic level.

At the higher economic level, it is seen that the native born Catholic Poles have a net reproduction rate equal to that of the Protestant native white of native parentage. The native born Italians and "mixed" Catholic nationalities have rates above that of the Protestant native white of native parentage. However, as will be noted, this latter group is of a higher economic status than the three Catholic groups, so that its lower net reproduction rate may be due to the economic differential.

Summary: The factor of Catholicism as an influence upon the birth rate appears to be of slight importance, as of 1930, particularly among the native born Roman Catholic women. Among the foreign born Catholic women, particularly during the 1920's, this religious factor may have been of great importance, but its importance appears to diminish with the passage of time. These results are not at all contradictory to those found by Stouffer[9] in his study of the Wisconsin cities.

FERTILITY OF THE JEWISH POPULATION

Foreign born: In order to compute the fertility of the foreign born Jewish population, two assumptions had to be made. The first is that the Russian born women now residing in this country are almost entirely Jewish. The second assumption is that those same women are representative of the great bulk of the Jewish migration which came from eastern Poland and western and southern Russia.[10] No attempt is

[9] Stouffer, *op. cit.*

[10] The basis for accepting the first assumption is as follows. In 1930 in the United States there were some 2,669,000 persons of Russian white stock, that is, of Russian birth or first generation born in the United States of Russian parentage. (*Fifteenth Census of the United States: 1930, Population*, Vol. II, chapter 6.) In 1926, the Bureau of the Census in its religous census (*Religious Bodies, 1926*, Vol. I, page 84) estimated that there were only 95,000 Russian Orthodox (subdivision of the eastern Orthodox church) church members in the United States. If these 95,000 represent all the non-Jewish Russians (including the native born of non-Jewish Russian parentage), then 3.8 per cent of the Russians can be said to be non-Jewish; if they represent but half of the non-Jewish Russians, then the per cent is raised to 7.6. Although it is not known exactly what proportion of the non-Jewish Russians these 95,000 Russian Orthodox church members represent, it would seem unlikely that they represent less than about one-fourth of all the non-Jewish Russians. In that case the percentage of all Russian stock which is Jewish is reduced to 85.

Data which make the second assumption appear valid are found in Volumes I and II of *International Migrations*. Between 1899 and 1924, about 1,800,000 Jews were estimated to have entered the United States. (W. F. Willcox, Editor, *International Migrations*, Vol. I, National Bureau of Economic Research, New York, 1929.) Of these, 70 per cent came from Russia and Poland. Central and eastern Europe combined, sent over 90 per cent of all the Jewish immigrants. Not only, then, did most of these

being made here to calculate rates for Jews coming from different European countries, as was done with the Catholics.

Like the net reproduction rates of the United States as a whole and of the Italian and Irish stocks previously described, the net reproduction rate of the foreign born Russian (Jewish) women has fallen considerably since 1925, the first year for which its computation was justified. In 1925 this rate was 1.29, in 1930 it was .93, and in 1935 it fell to .69 (see Table 4).

TABLE 4

NET REPRODUCTION RATES FOR SELECTED JEWISH AND NON-JEWISH GROUPS

Group	Net Reproduction Rates 1925	1930	1935
Russian born (total United States)*	1.29	.93	.69
Foreign born Jewish (Chicago)†	—	.68	—
Native born Jewish (Chicago)†	—	.64	—
Native white of native parentage (Chicago)†	—	.71	—
Total foreign born white (Chicago)§	—	.84	—
Total native born white (Chicago)§	—	.68	—

* These rates obtained from the same sources and in the same manner as the rates for the Irish and Italian groups. See first footnote, Table 1.

† See first footnote, Table 2. Median rental range of $40–$59.

§ Source: P. M. Hauser, *Differential Fertility, Mortality and Net Reproduction in Chicago, 1930*, Ph.D. Thesis, University of Chicago, 1938. Median rental range of $45–$59.

That this is possibly a maximum rate for the Jews is suggested by two factors. One is the possibility that the Jewish women born in Germany and northwestern Europe have a lower rate than the Russian born. Another factor which may tend to make the Russian born net reproduction rate a maximum is the possible inclusion of many births to Catholic Polish women among the reported births to Russian born women.[11]

Insofar as the factor of urbanization is concerned, the foreign born Russians are about as highly urbanized as any group, 90 per cent living in urban regions and 77 per cent living in cities of 100,000 population and over, as of 1930.

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immigrants come from the same general geographic area, but, apparently most of them came from the same social and economic class. (*Ibid.*, Vol. II, Chapter XVI, Liebmann Hersch, "International Migration of the Jews," pages 471–520.) Thus, it would seem that the population characterized as Russian born in the 1930 United States census of population, is a fairly representative sample of the foreign born Jewish population residing in the United States at that date.

[11] Some evidence that this is true lies in the fact that the net reproduction rate of the Polish born women in the United States in 1930 appears to be too low, only .81. It is thus possible that the 1930 rate for the Russians is exaggerated and that the falling net reproduction rates may represent to some extent a bettering of the birth registration reports in regard to country of birth of mother as well as a genuine fall in fertility.

In regard to economic status, it is found that the median monthly rental of urban rented non-farm homes was about $48, so that the Russian born are better off than the Irish or Italian. To the extent that they are of a higher economic status, their net reproduction rate can be expected to be lower than that of the Italians and possibly also of the Irish.

In Chicago in 1930, the net reproduction rate of foreign born Jewish women living in selected census tracts was found to be .68. All of the foreign born white women living in economically comparable areas (census tracts which had median rentals of $45 to $59 in 1930) had a net reproduction rate of .84.

Native born: Data for the native born Jewish women are available for the same selected census tracts in Chicago for which data were available for studying the rate of the foreign born Jewish women. The net reproduction rate of the native born Jewish women (mainly first generation born in this country) was .64, in 1930 (see Table 4). This is lower than that of economically comparable Protestant native white women of native parentage living in Chicago.

SUMMARY

Fertility of the Roman Catholic population: The evidence reviewed in this study (for the period 1920 to 1935) revealed no clear cut differentials between the net reproduction rates of the Catholic and non-Catholic populations. In general, the Italian born and the native born of Italian extraction have higher rates than other groups. The Catholic Irish, Polish, and the groups of miscellaneous nationalities, on the other hand, have rates about equal to or somewhat lower than the rates of comparable non-Catholic groups.

Fertility of the Jewish population: The net reproduction rates of both the foreign born and native born Jewish populations, in general, tend to be somewhat lower than rates of economically comparable Protestant stock. This is especially evident in the data of the city of Chicago.

REPRESENTATIVE SAMPLING IN LARGE-SCALE SURVEYS*

By Frederick F. Stephan
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Popular interest in sampling was aroused during the Presidential election campaign of 1936 by a spectacular contest between several systems of polling the American public. At the center of the fight was the *Literary Digest's* poll which asked millions of readers and non-readers to indicate their voting intentions on return postcard ballots. The prestige of this well-established poll was challenged by *Fortune Magazine's* Quarterly Survey of Public Opinion, Dr. George Gallup's American Institute of Public Opinion, and a number of other election forecasters. At the conclusion of the contest the *Literary Digest* Goliath fell heavily on the field of battle and the crowds on the surrounding hills witnessed a clear and dramatic demonstration that a sample of millions *can* go wrong.

The cause of the *Literary Digest's* humiliating defeat was evident: its postcard questionnaires reached and were returned by the predominantly Republican upper and middle income classes in greater proportions than they reached and were returned by the predominantly Democratic lower income classes. In contrast, *Fortune's* sample of only 4,000 interviews carefully apportioned by geographic location, age, sex, size of community, and economic level was quite successful in predicting the proportionate split of the popular vote. It was interpreted as indicating that Roosevelt would receive 61.7 per cent of the popular vote. The President actually received 60.7 per cent. The *Literary Digest* gave him only 40.9 per cent. The Gallup poll, reaching about 200,000 voters by a combination of postcard and interview methods, was affected to a lesser extent by the same kind of bias that tripped up the *Literary Digest*. It predicted 53.8 per cent of the popular vote for Roosevelt, 7 points below the actual percentage, but was much more successful in predicting the electoral vote than this discrepancy would indicate. (*Fortune* made no attempt to predict the vote state by state.) In continuing his polls after the Presidential election, Dr. Gallup laid aside post-card balloting in favor of interviewing samples of 3,000 to 50,000 voters and thereby improved greatly the precision of his forecasts. In the recent neck-and-neck race for the Governorship of New York State his poll came within one-half of one per cent of the actual proportion of the vote given to Lehman. Prominent public

* A paper presented at the One-hundredth Annual Meeting of the American Statistical Association in a joint session with the Institute of Mathematical Statistics, Detroit, Michigan, December 29, 1938.

officials and leaders of both major parties were quoted by the newspapers in high praise of the sampling methods of the American Institute of Public Opinion. "Scientific sampling" became front-page news.

The success of the new public opinion polls cannot be traced to any strikingly new principles of sampling. They employ procedures that were relatively simple and depended more on courage, common sense, and hard work than on abstruse scientific theories. Reliance on interviewing instead of postcard questionnaires and careful apportioning of the sample to the various important classes of voters were the principal features of the polls that put to shame the *Literary Digest's* blunderbuss methods.

The usefulness of sampling methods in large-scale surveys has been demonstrated in somewhat less spectacular manner by many interesting statistical inquiries. They have shown that, in comparison with complete canvasses, sampling methods may reduce greatly the total expense of surveys, make the results available more quickly, avoid the annoyance which is produced by repeated canvassing of the same persons, make lighter demands for personnel and equipment, and provide other important advantages of convenience and expediency. On the other hand, they have shown that it is easy to make mistakes in sampling and that these mistakes are often difficult to correct. They have also shown that sampling is not satisfactory if the data must be tabulated separately for many small geographic subdivisions or detailed classifications or if the data are highly variable. A sample furnishes only part of the information that can be secured by a complete canvass, yet for many purposes this part may be quite adequate and acceptable.[1]

It is costs that make the sample. If surveys and censuses involved no expense or inconvenience and if they could be taken instantaneously no one would accept the incomplete information given by a sample as a substitute for the full information obtainable from complete canvass. Just because considerations of economy, promptness, and convenience are involved in large-scale surveys, it is important that the sampling procedure be designed so as to minimize expense and practical difficulties without sacrificing unduly the reliability and usefulness of the results.

THREE TYPES OF SAMPLING

A great variety of practical objectives may be found in any group of typical sampling surveys that might be selected for study. The methods and the problems exhibited by each likewise vary.

[1] R. H. Coats, "Enumeration and Sampling in the Field of the Census," this JOURNAL, 26 (1931), 270–84. A. L. Bowley, "The Application of Sampling to Economic and Social Problems," this JOURNAL, 31 (1936), 474–80. S. A. Stouffer, "Statistical Induction in Rural Social Research," *Social Forces*, 13 (1935), 505–515.

Sample tabulations. The simplest cases are those of drawing samples from a set of survey schedules or a file of records already at hand. When an earthquake disaster interrupted the regular tabulations of the Japanese Census of 1920, a sample was chosen by taking every one-thousandth family enumerated in the Census. The tabulation of this sample was completed quickly and furnished statistics for the entire nation that agreed very closely with the regular tabulations when they were completed.[2] Similar sample tabulations have been made from the British employment office records[3] and from several studies of the Works Progress Administration.

Quite recently the Social Security Board undertook a sampling of all applicants for Social Security account numbers in order to secure information as to their age, sex, and color state by state. The 36,000,000 actuarial cards in the Baltimore files were sorted by the last digit of the account number and every card with a number ending in 5 was selected. The resulting sample of 3,600,000 cards was tabulated in the usual way. It is estimated that tabulation of all the 36,000,000 would have cost about seven times as much as this sample tabulation.[4] One can readily see that in surveys as large as this the savings that are possible by sampling may be very substantial.

Large corporations have used similar methods to make special surveys of their stockholders and employees from their record files and life insurance companies have sampled their policy holders. The sampling of record files can and should be extended. It offers great opportunities for special tabulations for research purposes which would be too complicated and too expensive if they were done for the whole file.

Sampling from a list for a survey. A similar type of sampling consists of selecting from some appropriate list a number of persons, households, buildings, farms or other subjects for which information not available in the records is to be sought by questionnaire or interview. Sometimes the best lists available are incomplete and biased; sometimes a bias is introduced by the method of selection from the list or by failure to secure information for some of the subjects selected for the sample. Even with these defects the resulting samples have been very useful. Professor A. L. Bowley's pioneer surveys using directory lists[5] and Miss Hogg's unemployment survey of New Haven[6] are good examples of this procedure. In the latter instance the best list available was the Gas Company's card file of its customers. Certain precautions

[2] *Bulletin de l'Institut International de Statistique*, 25 (1931), 2 ieme livraison, p. 121.

[3] *Journal of the Royal Statistical Society*, 87 (1924), 544 and 91 (1928), 519.

[4] *Social Security Bulletin*, 1 (1938), 60. I am indebted to Dr. Max Wasserman and Miss Ruth A. Keller of the Social Security Board for the cost estimates.

[5] *Journal of the Royal Statistical Society*, 76 (1913), 672.

[6] *The Incidence of Work Shortage* (New York: Russell Sage Foundation, 1932).

were taken to overcome its principal deficiencies. Cards were drawn at one-inch intervals in groups of 5 or 6 to secure a sample of 2,097 households, or 5 per cent of all the households in New Haven. These households were visited by interviewers and revisited when necessary. Only 8 persisted in refusing information and some data were secured for these 8 households from other sources. The data were tabulated in the usual way. When tested by comparison with the 1930 Census reports by age, sex, marital status, nativity, and industrial connection the sample of households was found to be quite representative of all New Haven households with respect to these characteristics. The method of selection does not satisfy a mathematical definition of choice at random but a strictly random selection would not have been notably superior in any practical sense. Another study of the same type was the New York Welfare Council's Youth Study, a survey of a sample of households secured by taking every 50th listed in the Real Property Inventory of New York.[7]

Sampling from a map for a survey. In a third type of sample survey, elementary areas, such as blocks, precincts, wards, enumeration districts, or even whole cities and counties, are selected for canvassing. Satisfactory maps may be available for the selection of these areas when lists of households are not to be had. It is easier to supervise the field force for such a sample and ordinarily there is a substantial saving in travel from one household to another in the actual canvassing.

In the National Health Survey conducted by the U. S. Public Health Service as a W.P.A. project a sample of 800,000 households in 84 cities was selected by taking many small districts at random in 31 larger cities and canvassing 53 smaller cities entire.[8] The cities were selected to be representative of the geographic distribution of the urban population and, as far as was feasible, its distribution by size of city. The detailed information secured in this survey could not have been collected for the entire urban population of the United States, except at prohibitive expense.

These examples exhibit some of the simpler sampling schemes that have been used in large-scale surveys; more complicated schemes have been used in such studies as the Michigan Unemployment Census,[9] the recent National Unemployment Census,[10] and the Consumer Pur-

[7] See *Better Times*, January 6, 1936, and June 1, 1936, and the full report soon to be published.

[8] The *National Health Survey, Preliminary Reports: Significance, Scope and Method*, (Washington: U. S. Public Health Service, 1938).

[9] State Emergency Welfare Relief Commission, State of Michigan, "Michigan Census of Population and Unemployment: Age, Sex and Employment Status of Gainful Workers in Five Types of Communities" (Lansing, Michigan, 1936).

[10] Calvert L. Dedrick and Morris H. Hansen, "The Enumerative Check Census," *Census of Partial Employment, Unemployment and Occupations; 1937* (Washington, D. C., 1938), pp. 159 ff.

chases Study conducted by the National Resources Committee, the Bureau of Labor Statistics, and the Bureau of Home Economics as a Works Progress Administration project.[11]

The choice of a scheme of sampling is often dictated in whole or in part by administrative considerations which have little relation to the subject matter of the inquiry. Each must be adapted to the circumstances under which it is used. Within these limitations one may improve his sampling procedure by utilizing the experience of previous sample surveys and by applying the theory of probability to the schemes that might be employed there is a trend toward the use of mathematical statistics in place of the old simple rule-of-thumb procedures. As the use of sampling expands this trend will continue. The contribution of the theory of sampling is not to provide a single method of sampling which should be used in all instances; it is to outline some general principles of design and to assist the investigator in anticipating from his knowledge of the circumstances just how a given sampling scheme will perform in practice.

STEPS TAKEN IN SAMPLING

The procedure of a sampling survey may be regarded as consisting of 8 distinct steps, although in practice some of the steps are usually combined:

1. *Choice of a "universe" or "population" to be sampled.* Dr. Gallup seeks to sample only voters; the *Fortune Survey* seeks to sample all adults whether they vote or not. Except in a few cities, the Consumer Purchases Study sought to secure expenditure data only for native white families. Often this choice of what is to be sampled is not made deliberately or with a clear distinction between a number of very similar universes that might be sampled. The methods which are employed may actually tap some other source than that which is intended.

2. *Discovery of a suitable means of access to the population.* The data that are desired may be sought by house-to-house canvass or other types of interviewing, by mail, or by reference to existing files of information. Sometimes several sources are combined as in the Special Population Census in Sweden taken in 1935. It utilized church registers, tax records, and house-to-house interviewing. If the inquiry is

[11] Erika H. Schoenberg and Mildred Parten, "Methods and Problems of Sampling Presented by the Urban Study of Consumer Purchases," this JOURNAL, 32 (1937), 311–322. See also Day Monroe, "Analyzing Families by Composition Type with Respect to Consumption;" Faith Williams, "Methods of Measuring Variations in Family Expenditures;" and the discussion by Hazel Kyrk, all in this JOURNAL, 32 (1937), 35–50, and Hildegarde Kneeland, Erika H. Schoenberg, and Milton Friedman, "Plans for a Study of the Consumption of Goods and Services by American Families," this JOURNAL, 31 (1936), 135–141.

to be conducted by mail a list of names and addresses is usually necessary but arrangements may be made as in the Rural Carrier Surveys of the Bureau of Agricultural Economics or the National Unemployment Census to have postal carriers leave ordinary questionnaires in each postal box on their routes. If house-to-house canvassing is to be done, a list of addresses may be used as in the New York Youth Survey, or a set of small areas may be canvassed completely as in the National Health Survey, or investigators may be asked to secure a fixed number of returns in a designated area without further limitation of their selection of households as in a survey of food consumption in New York City conducted by the Bureau of Agricultural Economics in 1935.

3. *Choice of a unit of sampling.* When the means of access to the population involves the use of a list, the unit of sampling may be defined automatically as the individual or household depending on whether the list is one of individuals or households. Similarly the unit may be the block, enumeration district, ward, township, or other elementary area if a map is used. Often there are several units available for use and that unit among them may be chosen which best meets all the practical circumstances of convenience and cost. Usually the smaller, more numerous, kind of unit is to be preferred since such a unit tends to produce less variable samples. However, it may be much more expensive to canvass a sample of many small units than one of a few large units.

4. *Choice of a method of selecting the sample.* One method is to let the sample select itself. Experience in questionnaire inquiries has shown that persons who return questionnaires usually differ in some important characteristics from those who do not and consequently a sample composed of such persons may be badly biassed. The unfortunate experience of the *Literary Digest* was principally due to this factor. Another method is to permit the interviewers to select the sample. This method also is likely to result in important biasses although they can be reduced by appropriate training and by certain restrictions on the interviewers' choice. Still another method is to ask an expert or a group of experts to select the sample on the basis of their knowledge of the population. This again may introduce a bias but if the experts actually know a great deal about the population they may select a very good sample, especially if the sample must consist of only a few units.

The existing knowledge of the population may be utilized to divide the population into parts such as geographic regions, economic classes, or other distinct groups each of which is to be sampled in a definite proportion as in the case of the Gallup and *Fortune* polls. To the extent

to which this "stratification" succeeds in controlling the variability of the population, it reduces the value of the judgment of experts in the further selection of the samples within the strata. Finally there is the method of "leave it to chance"—random selection—which may be very useful as a means of avoiding bias.

The method of selecting the sample is at the heart of the sampling problem. Some methods are more likely than others to produce samples that are representative, less likely to yield samples that are seriously misleading. If the method is random it enables one to apply the calculus of probability to the interpretation of the results. Ingenious schemes of selection may enhance greatly the value of the samples for use in connection with other data and may facilitate the work of the survey.[12]

5. *The actual selection of a sample.* The actual "drawing" of a sample is always something of a gamble. If one is lucky, he may secure a good selection of units to constitute his sample; if unlucky, one may draw a poor or misleading sample. Often one cannot tell whether he has been fortunate or unfortunate in this lottery. It provides but little aid and comfort to the victim of a poor draw in random sampling to assure him that "in the long run" the random method of selection will give him errors in one direction just as often as it will in the other. It is likewise no consolation to tell the victim of poor judgment, mistakes, or ignorance of important factors in a selection by the judgment of experts that his sample is quite representative for certain characteristics other than those which are of primary interest in his study. Some help is to be had, however, from tests of the sample against information already at hand. If the sample is found to be biased in some of the test factors it may be possible to select a new sample before the interviewing is begun or to set up some adjustments to be made in the final results as partial corrections for the bias. Great care is necessary in such "doctoring" of a sample to make sure that the medicine really helps the patient and does not poison him.

6. *Securing data for the units in the sample.* After the particular units that are to constitute the sample have been determined, it is necessary to observe them, interview them, write to them, or transcribe data from existing records for them. Sometimes it is difficult or impossible to secure information for every item in the sample and if the omission of

[12] J. Neyman, "On the Two Different Aspects of the Representative Method," *Journal of the Royal Statistical Society*, 97 (1934), 558–625 and "Contribution to the Theory of Sampling Human Populations," this JOURNAL, 33 (1938), 101–116. A. T. Craig, "On the Mathematics of the Representative Method of Sampling," *The Annals of Mathematical Statistics*, 10 (1939), 26–34. W. G. Cochran, "The Use of the Analysis of Variance in Enumeration by Sampling," to be published in the September 1939 issue of this JOURNAL.

some items is associated with characteristics relevant to the inquiry a serious bias may result.[13] Bowley and others have emphasized the necessity of repeated efforts to secure data for all the subjects which elude the first attempt. These difficulties are encountered in complete canvasses quite as much as in sampling. Good organization of the inquiry is necessary to make the collection of data satisfactory in either case.

7. *Tabulation and analysis of the sample data.* Here again the processes are similar to those of a complete survey but the possibility of "weighting" and "adjusting" the results to correct for known bias becomes more important.

8. *Application of the sample data to the problem in hand; use of the sample.* In this step it is important to recognize the weaknesses of the sample and to use it up but not beyond its limit of reliability. Here the theory of probability and error may be very helpful. Elementary logic and general knowledge of the subject matter are very important in checking and applying the results of a survey.[14] Blind faith that "the errors will cancel out" and careless anchoring of the beginning and end of a chain of statistical reasoning invite disaster in sampling quite as much in a sampling survey as they do in a complete canvass. Every one of these steps is covered with ice on which the unwary traveler may slip to his embarrassment and discomfort! No mathematical magic or logical acrobatics can surely save him from his fate once he has lost his balance.

TESTING SAMPLING METHODS

The objective of a survey is to determine certain definite but unknown economic and social facts most of which are expressible in terms of statistical tables, i.e., in terms of frequencies, proportions, and ratios and their associated definitions or class designations. One may imagine the existence of a "true" table which would have been the result of a perfect survey. The surveys that are actually made are not perfect. There are often important discrepancies between the statistical tables that they produce and the ideal or true table that is the objective of the inquiry. These discrepancies may be referred to as "systematic error" or bias. When a survey is made by sampling there is in addition an element of "chance error" due to the random influences in the selection of the sample. The total error of a sample is the sum of its systematic and random errors. For a great number of samples the mean square of the total error (or total error variance) is the sum of the

[13] Clyde V. Kiser, "Pitfalls in Sampling for Population Study," this JOURNAL, 29 (1934), 250–256.
[14] Jerome B. Cohen, "The Misuse of Statistics," this JOURNAL, 33 (1938), 657–675.

mean squares of the systematic and random errors. Now, if the random errors are large, as they are for small samples of highly variable units, relatively small systematic errors are of little consequence. If, on the other hand, the systematic errors are relatively large, the total error cannot be reduced very much by efforts to diminish the random errors. In such instances, one should not strain after the gnat of random error while swallowing the camel of systematic error. For this reason, the value of a sampling scheme for a particular survey project cannot be determined solely by its effectiveness in diminishing random error. As a corollary, the value of mathematical sampling theory will increase when improvements are made in the collection of data.

Given a set of limiting conditions, how can one draft the best plan for the sampling procedure or determine whether a suggested procedure will yield satisfactory results for the purposes of the survey? Mathematical principles of sampling procedure may tell one much about the chances of getting a bad draw in step 5 and often also about biases and their correction. They may provide a basis for comparing different units of sampling. They cannot help much if at all with biases due to the wording of questions, faulty judgment of experts, omission of certain kinds of cases, and similar influences.

These biases can only be determined by testing the actual data obtained in samples or in complete surveys with unbiassed data for the population from which they were drawn. The comparison of two or more samples taken by the same methods, or of subsamples within the principal sample, often provides a rough measure of the variability due to chance. It cannot detect "systematic error," more or less constant bias inherent in the methods used to get the samples. If two samples agree reasonably well this indicates not that they are free of bias but that their biases are similar.

The best test of sampling methods is to compare samples with the populations from which they are drawn. Of course, if this were possible in every instance, there would be no need to sample! Sometimes information is available for the population regarding one or more of the characteristics that are recorded for the sample. In such cases a limited comparison can be made. For example, every five years the Census of Agriculture provides a basis of comparison for testing the sample of crop reporters used by the Bureau of Agricultural Economics and every two years the Census of Manufactures furnishes a test of the Bureau of Labor Statistics Unemployment Index samples.

Very valuable and interesting tests of sampling methods looking toward an annual sample census of agriculture are being conducted by the Bureau of Agricultural Economics, the Bureau of the Census,

and several of the State Agriculture Colleges and State Agricultural Departments.[15]

In this hasty sketch of practical applications only the outlines of sampling procedure have been traced on our canvas. The picture would be much more interesting if we could brush on the colors. Even now we can see from the sketch the possibilities of a great expansion of the use of sampling in large-scale surveys. At the present time complete surveys and enumerations provide only a small fraction of the social and economic data that are greatly needed for research, legislation, and management. Exploratory studies conducted according to sound sampling procedure can supply very useful information pending the collection of complete data on any specific subject and, in addition, they can be used to test and perfect questions, definitions, tabulation plans, and other phases of the complete canvass technique.

As some subjects graduate from partial survey to complete survey, new subjects of inquiry will be examined by sampling methods. Special samples will be used to test the accuracy and completeness of supposedly complete surveys and to provide supplementary data which could not be included in the survey schedules. In the tabulation of censuses, certain difficult or expensive combinations of data will be both feasible and satisfactory if they are prepared according to an appropriate sampling scheme. Such special tabulations recover from the ore much precious metal which would not have been secured in the ordinary refining processes. Finally, complete surveys are so expensive that they are seldom made at very frequent intervals. In the intervals between complete canvasses, the gaps can be filled by partial surveys. The latter may show a considerable gain in accuracy when they are tied back to the preceding complete canvasses. In the prospect of these increasing applications of sampling one can see a great need for careful planning, ingenious design, patient testing, and brilliant mathematical research.

[15] C. F. Sarle, "Development of Partial and Sample Census Methods," and Irvin Holmes, "Results of Four Methods of Sampling Individual Farms," *Journal of Farm Economics*, 21 (1939), 357–364 and 365–374 respectively.

THE LEAST-SQUARES STANDARD ERROR OF THE COEFFICIENT OF ELASTICITY OF DEMAND[1]

By Jacob L. Mosak

In an article published in 1933 Professor Henry Schultz derived an *upper limit* to the standard error of the coefficient of elasticity of a linear demand function which is fitted to the observation data by the method of least squares.[2] The present article carries the method a step further and shows how the value of the standard error itself may be determined for any point on the demand function. We shall show in particular that when the elasticity of demand, η, is evaluated at the point of means of the variables, its standard error, σ_η, may be obtained from the very simple equation,

$$\frac{\sigma_\eta^2}{\eta^2} = \frac{\sigma_{M_1}^2}{M_1^2} + \frac{\sigma_{b_{12}}^2}{b_{12}^2}.$$

Let the demand function fitted by the method of least squares be

$$(1) \quad X_1' = b_{11} + b_{12}X_2 + b_{13}X_3 + \cdots + b_{1i}X_i + \cdots + b_{1k}X_k,$$

where X_1 stands for quantity demanded, X_2 for price, and $X_3, \cdots, X_k$ for the remaining variables. The prime on X_1 indicates that it is the computed value of X_1.

Statistically, this demand function is simply the elementary regression of X_1 on the remaining variables, the parameters of which are obtained by minimizing the sum of the squares of the residuals of X_1:

$$(2) \quad \sum V_1^2 = \sum \{X_1 - (b_{11} + b_{12}X_2 + b_{13}X_3 + \cdots + b_{1i}X_i + \cdots + b_{1k}X_k)\}^2.$$

As is well known, this fitting process assumes that only the observations in X_1 are subject to error, the independent variables $X_2, \cdots, X_k$ being free from errors.

By definition the partial elasticity of demand is

$$(3) \quad \eta = \frac{\partial X_1'}{\partial X_2}\frac{X_2}{X_1'} = b_{12}\frac{X_2}{X'_1} = \eta(b_{12}, X_2, X_1'),$$

where X_1' is the computed demand corresponding to the given values of X_2 and of the other independent variables. The problem is to determine the standard error, σ_η, of this function.

[1] I am thankful to Professor Henry Schultz for his helpful suggestions.

[2] H. Schultz, "The Standard Error of the Coefficient of Elasticity of Demand," this Journal Vol. 28 (1933), pp. 64–69, and reprinted with some revisions in his *Theory and Measurement of Demand* (Chicago, 1938), Appendix D.

Since in the curve-fitting process we have assumed the independent variables to be free from error, it is apparent that an error $\Delta\eta$ in η can arise only through corresponding errors Δb_{12} and $\Delta X_1'$ in b_{12} and X_1' respectively. We have, therefore:

$$\eta + \Delta\eta = \eta(b_{12} + \Delta b_{12},\ X_2,\ X_1' + \Delta X_1'). \tag{4}$$

The Taylor expansion of this function is convergent[3] for all values of $|\Delta X_1'| < |X_1'|$. For all such values we may therefore take as a first approximation

$$\Delta\eta = (\partial\eta/\partial b_{12})\Delta b_{12} + (\partial\eta/\partial X_1')\Delta X_1'. \tag{5}$$

This is equation (7) of Prof. Schultz's article with the term involving ΔX_2 omitted.[4]

Since from eq. (3) we have

$$\partial\eta/\partial b_{12} = X_2/X_1' = \eta/b_{12}, \text{ and } \partial\eta/\partial X_1' = -b_{12}X_2/X_1'^2 = -\eta/X_1',$$

[3] The expansion of (4) is as follows:

$$(\alpha)\quad \eta + \Delta\eta = (b_{12} + \Delta b_{12})\frac{X_2}{X_1' + \Delta X_1'} = \eta(b_{12} + \Delta b_{12},\ X_2,\ X_1' + \Delta X_1')$$

$$(\beta)\quad \eta + \Delta\eta = \eta(b_{12}, X_2, X_1') + \frac{X_2}{X_1'}\Delta b_{12} + \left(\frac{-b_{12}X_2}{X_1'^2}\right)\Delta X_1'$$
$$+ \frac{1}{2!}\left[2\left(\frac{-X_2}{X_1'^2}\right)\Delta b_{12}\Delta X_1' + \frac{2b_{12}X_2}{X_1'^3}(\Delta X_1')^2\right]$$
$$+ \frac{1}{3!}\left[3\left(\frac{2X_2}{X_1'^3}\right)\Delta b_{12}\cdot(\Delta X_1')^2 + \left(\frac{-6b_{12}X_2}{X_1'^4}\right)(\Delta X_1')^3\right]$$
$$+ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$
$$+ (-1)^{n-2}\frac{X_2}{(X_1')^{n-1}}\Delta b_{12}(\Delta X_1')^{n-2}$$
$$+ (-1)^{n-1}\frac{b_{12}X_2}{(X_1')^n}\cdot(\Delta X_1')^{n-1} + \cdots$$

where $n \geqq 2$.

Each of the last two expressions in (β) represents the n^{th} term u_n in an infinite series. Using Cauchy's ratio test for convergence (see e.g., Granville, Smith, and Longley, *Elements of the Differential and Integral Calculus* (Boston, 1929), p. 342, we obtain for each of the series

$$\rho = \lim_{n\to\infty}(u_{n+1}/u_n) = -\Delta X_1'/X_1'.$$

Each series is absolutely convergent for all values of $|\rho| < 1$ i.e. for all values of $|\Delta X_1'| < |X_1'|$. In our problem X_1' is always positive.

[4] See Schultz *op. cit.*, pp. 66–67. Since Prof. Schultz was deriving only an *upper limit* for σ_η and not the value of σ_η itself, he retained the term involving ΔX_2. In deriving the exact value of σ_η, however, we must, of course, write $\Delta X_2 = 0$, since the demand function (1) as well as the standard errors of the regression coefficients and of the function X_1' are all obtained on the assumption that the independent variables are free from errors.

equation (5) may be written more simply as

$$\Delta\eta/\eta = \Delta b_{12}/b_{12} - \Delta X_1'/X_1'. \tag{6}$$

Equation (6) states that to a first approximation[5] the error in η is a linear function of the errors in the regression coefficient b_{12} and in the demand function X_1'. Treating these errors as sampling errors we readily obtain by the formula for the variance (σ^2) of the difference between two related variables:

$$\sigma_\eta^2/\eta^2 = \sigma_{b_{12}}^2/b_{12}^2 + \sigma_{X_1'}^2/X_1'^2 - 2r_{b_{12}X_1'}\sigma_{b_{12}}\sigma_{X_1'}/(b_{12}X_1'). \tag{7}$$

This corresponds to eq. (9) of Prof. Schultz's article.

The standard error $\sigma_{b_{12}}$ offers no difficulty, since it is determined in the least-squares curve fitting process.[6] The standard error $\sigma_{X_1'}$ likewise offers no difficulty, since it is simply the standard error of the function X_1' which Prof. Schultz has shown how to compute.[7] But the correlation $r_{b_{12}X_1'}$ is thus far unknown, and σ_η cannot, therefore, be evaluated in the form in which it appears in eq. (7).

For a solution of the problem we must return instead to eq. (6) and first recall how the error in b_{12} and in X_1' are determined.[8]

If we let D denote the determinant of the coefficients in the normal equations and D_{ij} be the cofactor of the element in the i^{th} row and j^{th} column, then the solution of the regression coefficients b_{1i} ($i=1, \cdots, k$) in terms of determinants is:

$$b_{1i} = \sum X_1(D_{1i}/D) + \cdots + \sum X_1X_i(D_{ii}/D) + \cdots + \sum X_1X_k(D_{ki}/D). \tag{8}$$

[5] If the errors are sufficiently small—theoretically if they are infinitesimal—then eq. (6) is *exact* and not a first approximation. This may readily be seen by taking the logarithms of both sides of (3) and differentiating. We then have (recalling that X_1 is assumed to be accurate):

$$d \log \eta = d \log b_{12} - d \log X_1',$$

or,

$$d\eta/\eta = db_{12}/b_{12} - dX_1'/X_1'.$$

[6] The σ's in (7) as well as in the following equations relate, of course, to the *true* values of the population. But these true values are unknown and in theory can be found only by taking an infinitely large number of samples. In practice we must therefore substitute for the *true* values the *most probable* values of the standard errors obtained from the sample.

[7] Prof. Schultz has termed it the standard error of a forecast from a curve. See his "Standard Error of a Forecast from a Curve," this JOURNAL XXV (1930), pp. 139–185.

[8] For a detailed development of the formulas for the standard errors of the regression coefficients and of the function X_1', see the article by Prof. Schultz cited in the previous footnote, as well as his *Theory and Measurement of Demand*, Appendix C.

Let $X_i^{(\tau)}$ denote the τ-th observation ($\tau = 1, \cdots, n$) in X_i. Since the regression coefficients b_{1i} are linear in $X_1^{(1)}, \cdots, X_1^{(\tau)}, \cdots, X_1^{(n)}$, equation (8) may be written as

$$b_{1i} = a_{1.i}^{(1)} X_1^{(1)} + \cdots + a_{1.i}^{(\tau)} X_1^{(\tau)} + \cdots + a_{1.i}^{(n)} X_1^{(n)}, \tag{9}$$

in which the a's are functions of the independent variables $X_2, \cdots, X_k$ which are assumed to be accurate.

It is from equation (9) that we obtain the variances (σ^2) of b_{1i}. For equation (9) states that b_{1i} is a linear function of the observations in $X_1^{(\tau)}$ which by assumption are independent of each other. If we let ϵ_1^2 denote the variance of X_1 about the regression line (i.e. the square of the standard error or, as it is often termed, the quadratic mean error of the observed $X_1^{(\tau)}$)[9] then we have by the formula for the variance of a linear function of several independent quantities

$$\sigma_{b_{1i}}^2 = a_{1.i}^{(1)2}\,\epsilon_1^2 + \cdots + a_{1.i}^{(\tau)2}\,\epsilon_1^2 + \cdots + a_{1.i}^{(n)2}\,\epsilon_1^2 = \sum_1^n a_{1.i}^{(\tau)2}\,\epsilon_1^2. \tag{10}$$

Similarly the covariance $p_{b_{1i}b_{1j}} \equiv r_{b_{1i}b_{1j}}\sigma_{b_{1i}}\sigma_{b_{1j}}$ of the regression coefficients b_{1i} and b_{1j} is given by

$$\begin{aligned} p_{b_{1i}b_{1j}} &= a_{1.i}^{(1)}a_{1.j}^{(1)}\epsilon_1^2 + \cdots + a_{1.i}^{(\tau)}a_{1.j}^{(\tau)}\epsilon_1^2 + \cdots + a_{1.i}^{(n)}a_{1.j}^{(n)}\epsilon_1^2 \\ &= \sum_1^n a_{1.i}^{(\tau)}a_{1.j}^{(\tau)}\epsilon_1^2. \end{aligned} \tag{11}$$

The quantities $\sum_1^n a_{1.i}^{(\tau)2}$ and $\sum_1^n a_{1.i}^{(\tau)}a_{1.j}^{(\tau)}$ which we shall designate as $c_{1.ii}$ and $c_{1.ij}$ respectively[10] are obtained simultaneously with the solution of the regression coefficients b_{1i} by a modified form of Gauss' method of substitution. It is well known that in terms of determinants

$$c_{1.ii} = D_{ii}/D, \qquad \text{and} \qquad c_{1.ij} = D_{ij}/D, \tag{12}$$

[9] Theoretically, of course, ϵ_1^2 relates to the true population variance of X_1 which would be obtained from an infinite number of samples. Since in practice, however, we have only one sample, we must take the best estimate of ϵ_1^2, which is given by

$$\epsilon_1^2 = \sum V_1^2/(n-k),$$

where V_1 is defined above in equation (2), n = number of observations, and k = number of parameters in the demand equation.

[10] See Henry Schultz, *The Theory and Measurement of Demand*, Appendix C.

so that equations (10) and (11) may be rewritten as

$$\overset{2}{\sigma}_{b_{1i}} = \overset{2}{\epsilon}_1 c_{1.ii} = \overset{2}{\epsilon}_1 D_{ii}/D, \qquad \text{and} \tag{13}$$

$$p_{b_{1i}b_{1j}} = \overset{2}{\epsilon}_1 c_{1.ij} = \overset{2}{\epsilon}_1 D_{ij}/D. \tag{14}$$

The standard error $\sigma_{X_1'}$ of the function X_1' may then be obtained as follows:

Since the errors in X_1' are due to errors in the parameters $b_{1i}(i=1, \cdots, k)$, we may write the demand function (1) in the form

$$X_1' = f(b_{11}, \cdots, b_{1i}, \cdots, b_{1k}). \tag{15}$$

Then we have for the error in the function X_1'

$$\Delta X_1' = \frac{\partial f}{\partial b_{11}} \Delta b_{11} + \cdots + \frac{\partial f}{\partial b_{1i}} \Delta b_{1i} + \cdots + \frac{\partial f}{\partial b_{1k}} \Delta b_{1k}. \tag{16}$$

The variance of the function is therefore given by

$$\begin{aligned} \overset{2}{\sigma}_{X_1'} = {} & \left(\frac{\partial f}{\partial b_{11}}\right)^2 \overset{2}{\sigma}_{b_{11}} + \cdots + \left(\frac{\partial f}{\partial b_{1i}}\right)^2 \overset{2}{\sigma}_{b_{1i}} + \cdots + \left(\frac{\partial f}{\partial b_{1k}}\right)^2 \overset{2}{\sigma}_{b_{1k}} \\ & + 2 \frac{\partial f}{\partial b_{11}} \frac{\partial f}{\partial b_{1i}} p_{b_{11}b_{1i}} + \cdots + 2 \frac{\partial f}{\partial b_{1(k-1)}} \frac{\partial f}{\partial b_{1k}} p_{b_{1(k-1)}b_{1k}}, \end{aligned} \tag{17}$$

or from (13) and (14)

$$\begin{aligned} \overset{2}{\sigma}_{X_1'} = \overset{2}{\epsilon}_1 \Bigg\{ & \left(\frac{\partial f}{\partial b_{11}}\right)^2 c_{1.11} + \cdots + \left(\frac{\partial f}{\partial b_{1i}}\right)^2 c_{1.ii} + \cdots \\ & + \left(\frac{\partial f}{\partial b_{1k}}\right)^2 c_{1.kk} + 2 \frac{\partial f}{\partial b_{11}} \frac{\partial f}{\partial b_{1i}} c_{1.1i} + \cdots \\ & + 2 \frac{\partial f}{\partial b_{1(k-1)}} \frac{\partial f}{\partial b_{1k}} c_{1.(k-1)k} \Bigg\}. \end{aligned} \tag{18}$$

Of course, the standard error of X_1' is simply the square root of (18). We may now proceed to determine the standard error of the function η in an exactly similar manner.

Substituting into (6) the expression for $\Delta X_1'$ obtained in (16), we have

$$\frac{\Delta \eta}{\eta} = \frac{\Delta b_{12}}{b_{12}} - \frac{1}{X_1'} \left(\frac{\partial f}{\partial b_{11}} \Delta b_{11} + \frac{\partial f}{\partial b_{12}} \Delta b_{12} + \cdots + \frac{\partial f}{\partial b_{1k}} \Delta b_{1k} \right) \tag{19}$$

or

$$\frac{-\Delta\eta}{\eta} = \frac{1}{X_1'}\frac{\partial f}{\partial b_{11}}\Delta b_{11} + \left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{12}} - \frac{1}{b_{12}}\right)\Delta b_{12} + \frac{1}{X_1'}\frac{\partial f}{\partial b_{13}}\Delta b_{13} + \cdots + \frac{1}{X_1'}\frac{\partial f}{\partial b_{1k}}\Delta b_{1k}. \tag{20}$$

Again treating these errors as sampling errors, we obtain by the formula for the variance of a sum of several related quantities

$$\begin{aligned}\frac{\sigma_\eta^2}{\eta^2} = {} & \frac{1}{X_1'^2}\left(\frac{\partial f}{\partial b_{11}}\right)^2\sigma_{b_{11}}^2 + \left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{12}} - \frac{1}{b_{12}}\right)^2\sigma_{b_{12}}^2 + \frac{1}{X_1'^2}\left(\frac{\partial f}{\partial b_{13}}\right)^2\sigma_{b_{13}}^2 \\ & + \cdots + \frac{1}{X_1'^2}\left(\frac{\partial f}{\partial b_{1k}}\right)^2\sigma_{b_{1k}}^2 \\ & + 2\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{11}}\right)\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{12}} - \frac{1}{b_{12}}\right)\rho_{b_{11}b_{12}} \\ & + 2\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{11}}\right)\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{13}}\right)\rho_{b_{11}b_{13}} + \cdots \\ & + 2\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{1(k-1)}}\right)\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{1k}}\right)\rho_{b_{1(k-1)}b_{1k}}.\end{aligned} \tag{21}$$

Subsituting into (21) the partial derivatives of the demand function obtained from (1) and the values of $\sigma_{b_{1i}}^2$ and $\rho_{b_{1i}b_{1j}}$ obtained from (13) and (14), we obtain

$$\begin{aligned}\frac{\sigma_\eta^2}{\eta^2} = \epsilon_1^2\Bigg\{ & \frac{c_{1.11}}{X_1'^2} + \left(\frac{\eta-1}{b_{12}}\right)^2 c_{1.22} + \left(\frac{X_3}{X_1'}\right)^2 c_{1.33} \\ & + \cdots + \left(\frac{X_k}{X_1'}\right)^2 c_{1.kk} + 2\left(\frac{\eta-1}{b_{12}X_1'}\right)c_{1.12} \\ & + 2\left(\frac{X_3}{X_1'^2}\right)c_{1.13} + \cdots + 2\left(\frac{X_k}{X_1'^2}\right)c_{1.1k} \\ & + 2\left(\frac{(\eta-1)X_3}{b_{12}X_1'}\right)c_{1.23} + \cdots + 2\left(\frac{(\eta-1)X_k}{b_{12}X_1'}\right)c_{1.2k} \\ & + 2\left(\frac{X_3}{X_1'}\cdot\frac{X_4}{X_1'}\right)c_{1.34} + \cdots + 2\left(\frac{X_{k-1}}{X_1'}\cdot\frac{X_k}{X_1'}\right)c_{1.(k-1)k}\Bigg\}.\end{aligned} \tag{22}$$

From this we readily obtain the value of the standard error, σ_η. Equa-

tion (22) can be stated in more elegant form if we define the elasticity of demand with respect to any variable X_i as

$$\eta_{1i} \equiv \frac{\partial X_1'}{\partial X_i}\frac{X_i}{X_1'} = b_{1i}\frac{X_i}{X_1'}, \tag{23}$$

and substitute this expression into (22). We then have

$$\frac{\overset{2}{\sigma}_{\eta_{12}}}{\eta_{12}^2} = \epsilon_1{}^2\left\{\frac{c_{1.11}}{X_1'^2} + \left(\frac{\eta_{12}-1}{b_{12}}\right)^2 c_{1.22} + \frac{\overset{2}{\eta}_{13}}{b_{13}^2}c_{1.33} + \cdots + \frac{\overset{2}{\eta}_{1k}}{b_{1k}^2}c_{1.kk} + 2\frac{\eta_{12}-1}{b_{12}X_1'}c_{1.12} + \cdots + 2\frac{\eta_{1(k-1)}}{b_{1(k-1)}}\cdot\frac{\eta_{1k}}{b_{1k}}c_{1.(k-1)k}\right\}. \tag{24}$$

When the independent variables are shifted to their respective means as origins the formula for the standard error is somewhat simplified.

Let x_i be the deviation of X_i from its mean M_i, or

$$x_i = X_i - M_i. \tag{25}$$

Then equation (1) may be written as

$$X_1' = M_1 + b_{12}x_2 + b_{13}x_3 + \cdots + b_{1i}x_i + \cdots + b_{1k}x_k. \tag{26}$$

The standard errors of the regression coefficients are, of course, invariant under the transformation. The reciprocal of the weight of M_i is equal to $1/n$, so that the standard error of M_1 is given by the well known relationship

$$\overset{2}{\sigma}_{M_1} = \overset{2}{\epsilon}_1/n. \tag{27}$$

The reciprocals of the weights of M_1 taken jointly with the other regression coefficients are equal to zero, so that the covariance $p_{M_1 b_{1i}} = 0$.

The variance of the demand function is therefore given by

$$\overset{2}{\sigma}_{X_1'} = \left(\frac{\partial f}{\partial M_1}\right)^2\overset{2}{\sigma}_{M_1} + \cdots + \left(\frac{\partial f}{\partial b_{1i}}\right)^2\overset{2}{\sigma}_{b_{1i}} + \cdots + \left(\frac{\partial f}{\partial b_{1k}}\right)^2\overset{2}{\sigma}_{b_{1k}} + 2\frac{\partial f}{\partial b_{12}}\frac{\partial f}{\partial b_{1i}}p_{b_{12}b_{1i}} + \cdots + 2\frac{\partial f}{\partial b_{1(k-1)}}\frac{\partial f}{\partial b_{1k}}p_{b_{1(k-1)}b_k}, \tag{28}$$

or

$$\overset{2}{\sigma}_{X_1'} = \overset{2}{\epsilon}_1\left\{\frac{1}{n} + \overset{2}{x}_2c_{1.22} + \cdots + \overset{2}{x}_ic_{1.ii} + \cdots + \overset{2}{x}_kc_{1.kk} + 2x_2x_3c_{1.23} + \cdots + 2x_{k-1}x_kc_{1.(k-1)k}\right\}. \tag{29}$$

Similarly equation (21) for σ_η^2/η^2 reduces to:

$$
\begin{aligned}
\frac{\sigma_\eta^2}{\eta^2} = {} & \frac{1}{X_1'^2}\left(\frac{\partial f}{\partial M_1}\right)^2 \sigma_{M_1}^2 + \left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{12}} - \frac{1}{b_{12}}\right)^2 \sigma_{b_{12}}^2 \\
& + \frac{1}{X_1'^2}\left(\frac{\partial f}{\partial b_{13}}\right)^2 \sigma_{b_{13}}^2 + \cdots + \frac{1}{X_1'^2}\left(\frac{\partial f}{\partial b_{1k}}\right)^2 \sigma_{b_{1k}}^2 \\
& + 2\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{12}} - \frac{1}{b_{12}}\right)\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{13}}\right) p_{b_{12}b_{13}} + \cdots \\
& + 2\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{1(k-1)}}\right)\left(\frac{1}{X_1'}\frac{\partial f}{\partial b_{1k}}\right) p_{b_{1(k-1)}b_{1k}}.
\end{aligned} \tag{30}
$$

Substituting into (30) the partial derivatives of the demand function obtained from (26), we obtain finally:

$$
\begin{aligned}
\frac{\sigma_\eta^2}{\eta^2} = {} & \frac{\sigma_{M_1}^2}{X_1'^2} + \left(\frac{x_2}{X_1'} - \frac{1}{b_{12}}\right)^2 \sigma_{b_{12}}^2 + \left(\frac{x_3}{X_1'}\right)^2 \sigma_{b_{13}}^2 + \cdots \\
& + \left(\frac{x_k}{X_1'}\right)^2 \sigma_{b_{1k}}^2 + 2\left(\frac{x_2}{X_1'} - \frac{1}{b_{12}}\right)\left(\frac{x_3}{X_1'}\right) p_{b_{12}b_{13}} + \cdots \\
& + 2\,\frac{x_{k-1}}{X_1'}\cdot\frac{x_k}{X_1'}\, p_{b_{1(k-1)}b_{1k}}.
\end{aligned} \tag{31}
$$

When, as is usually true, the elasticity of demand is evaluated at the point of means of the variables, then $X'_1 = M_1$, and $x_2 = x_3 = \cdots = x_k = 0$. Equation (31) then reduces to the very simple form:

$$
\frac{\sigma_\eta^2}{\eta^2} = \frac{\sigma_{M_1}^2}{M_1^2} + \frac{\sigma_{b_{12}}^2}{b_{12}^2}. \tag{32}
$$

As an illustration of the method for determining the standard error of η we may use the same demand function which Professor Schultz gives in his *Theory and Measurement of Demand*, Appendix D—the demand function for sugar for 1875–95. It is

$$
X = 70.62 - (2.259 \pm 0.7322)Y + (0.8371 \pm 0.2152)t, \tag{33}
$$

where $X = X_1$ is the per capita consumption in pounds, $Y = X_2$ is the deflated price in cents per pound, and $t = X_3$ is the time in years, the origins of X and Y being at 0 and the origin of t at the middle of the period.

At the point of means of the independent variables the elasticity of demand is

$$\eta = \frac{\partial X}{\partial Y}\frac{Y}{X} = -2.259\frac{M_2}{M_1} = -0.3622 \tag{34}$$

$$(M_2 = 8.313;\ M_1 = 51.843).$$

The upper limit of the standard error of this coefficient given by Professor Schultz is

$$\sigma_\eta < 0.1553. \tag{35}$$

The exact value of σ_η evaluated at this point may be readily obtained by means of equation (32). We have:

$$\overset{2}{\sigma}_{M_1} = \overset{2}{\epsilon}_1/n = 0.4136 \qquad M_1^2 = 2687.4$$
$$\overset{2}{\sigma}_{b_{12}} = 0.5361 \qquad b_{12}^2 = 5.103$$
$$\overset{2}{\eta} = 0.1311.$$

Substituting these values into (32) we obtain

$$\sigma_\eta^2 = 0.01380,$$

and, therefore:

$$\sigma_\eta = \pm 0.1175. \tag{36}$$

The ratio of η to this standard error is

$$t = \pm 0.3622/0.1175 = \pm 3.083.$$

When the upper limit of σ_η yielded by (35) is substituted in the foregoing expression, the ratio reduces to

$$t = \pm 0.3622/0.1553 = \pm 2.332.$$

When both η and σ_η are determined directly from a constant-elasticity curve fitted to the same data by the method of least-squares,[11] the ratio becomes

$$t = \pm 0.3828/0.1224 = \pm 3.127.$$

It is clear from these results that the use of the upper limit for σ_η tends to underestimate the statistical significance of the elasticity of demand derived from the linear demand function.

[11] See Henry Schultz, *The Theory and Measurement of Demand*, Appendix D, equation (19).

NOTES

A SCIENTIFIC BASIS FOR STANDARD SIZES FOR CHILDREN'S GARMENTS AND PATTERNS

Large scale production and technological development have always gone hand in hand with standardization. But there is one large scale industry which has escaped this inevitable process, and that is the garment industry. The need for standard sizes in garments and patterns has been felt for a long time by consumers, retailers, and producers. Attempts have been made by groups of manufacturers to get together and agree on a set of standards to be used by the industry. These attempts were sporadic in nature and seldom yielded satisfactory results. One reason for this failure is that the standards agreed upon rarely had any relation to the bodily structure of the people whom the garments were supposed to clothe. What was needed here was not merely a set of standards but standards based on actual measurements taken on the human body and scientifically analyzed. This procedure the garment industry never systematically carried out and the result is that there are almost as many size-norms for garments and patterns as there are manufacturers. This is especially true in the field of women and children's garments and patterns.

In children's garments and patterns, sizes have been traditionally designated by age, presumably upon the assumption that age is the best indicator of the body build of a child. That this assumption is false is known to almost every layman and especially to every mother who buys garments for her children. But the industry, not having any scientific basis to make a substitution for age, has continued with this designation for decades.

Leadership in discovering a scientific basis for standard sizes for children's garments and patterns was undertaken in the early part of 1937 by the Bureau of Home Economics, United States Department of Agriculture. Funds were provided by the Works Progress Administration. In cooperation with many colleges, universities, and other educational institutions, the Bureau has measured 147,000 children, ages 4 to 17, in 15 States of the Union and the District of Columbia. The measurements (36 in number) were decided upon by trained anthropologists with the cooperation of the leading manufacturers and retailers of the garment industry. The children were sampled from public schools, private schools, nurseries, and playgrounds. The measurers were trained by anthropologists and a close check on their accuracy was kept by means of an extensive process of duplications. The

statistical analysis of the measurements was carried out in a large statistical pool in Washington, D. C.

From a statistical point of view, the problem of setting up size-norms is the problem of choosing a finite number of points in a 36 dimensional space (since 36 measurements were taken on every child) around which most of the other points would cluster. Each of these points would represent a standard size or mannequin. In actual practice it would be inadvisable to use more than a few measurements as a basis for size designations. It became essential, therefore, to choose one measurement or a combination of measurements which, when held constant, would reduce the variation of the other measurements to a minimum. The search for such basic measurements was undertaken on three large independent samples. Twenty out of 36 measurements were chosen and were put through an extensive statistical analysis. Bivariate distributions for these 20 measurements were obtained, together with correlations of every possible combination of two of these measurements. As a further refinement, 8 out of the 20 measurements were chosen, and regression equations of each of the 20 measurements on combinations of 2 and 3 of these 8 measurements were calculated. A study of the multiple correlations together with a factor analysis brought out the following facts:

a. Age, as was expected, is a very poor indicator of body build of children, and, if sizes are to be based on only one measurement, weight is the best one to use. However, weight by itself, though it reduces the variation of the girths, does not explain the variation of the lengths.

b. The best combinations of two measurements are: stature and weight, and stature and girth of the hips. Stature and chest girth though not as good, may also be used.

c. Including a third measurement in a selected combination of two, does not further decrease the variation of the other measurements to an appreciable extent.

Having decided on a combination of two measurements which are to be used as a basis for standard sizes, the next problem is to break up the distribution of that combination into size-norms. Essentially the problem is to determine on the basis of two measurements, a finite number of vectors in a 36 dimensional space. This can be done in either of two ways: (1) Select the finite points from the bivariate distribution of the combination chosen and predict the other 34 measurements from regression formulas, and (2) Break up the bivariate distribution of the combination chosen into intervals, and calculate the averages of

the children falling in any given interval of this combination for the other measurements. Because of the non-linearity of the regression equations and for other practical considerations it was decided to use the latter procedure. Three problems still remained to be settled: (1) what shape of intervals to use, (2) how many intervals, and (3) how large the intervals were to be. After a great deal of experimentation, it was decided that rectangles are the simplest and the most practical intervals. The second and third questions are much more difficult to answer. It is obvious that the size and number of intervals chosen will determine the "distance" between one vector and another in the 36 dimensional space. How many and how far apart should these vectors be? This has no statistical answer at present, since it depends upon such elusive elements as "allowances" and comfort. The final decision will have to be made by the manufacturers and retailers themselves who have had experience in fitting garments.

The solution to the problem of garment sizes came about as a by-product of a pure anthropometric study which had to be conducted before the essential conclusions were reached. Consequently a tremendous amount of information relating to body measurements of children was obtained in this study: e.g., relationships between a great many measurements, distributions of measurements, growth curves and age averages and correlations. An interesting study was also carried out relating to differences in body build of children, due to regional differences, sex differences, and socio-economic differences. A great many striking results were obtained from these studies. In all these analyses, modern statistical techniques were employed. Some of these techniques had seldom before been applied to such a large scale study.

It is hoped that the final report of the findings and conclusions will be ready for publication by the end of June 1939.

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A STATISTICAL BASIS FOR SETTING WAGE RATES*

In 1936 and 1937, with the unionization of its Emeryville plant, the management of a large Pacific Coast factory, found itself faced with the problem of setting wage rates in negotiations with the 17 unions representing the plant employees. During the negotiations it was found that neither the employees nor the management had any definite measure of what each job in the plant was worth. In cases of difference in opinion the result depended on generalization by both parties, and usually ended in a compromise rate, which may or may not have represented the actual facts of the matter. Before the negotiations of 1938, the management requested the Industrial Engineering Department to work up some factual method of rating jobs, so that there would be a scientific basis for estimating the relative values of different jobs in the plant.

First we canvassed the work done by other concerns faced with the same problem. A number of companies were using job ratings, and some of the systems had been in use for a considerable time. A particularly detailed program had been worked out by the Columbia Steel Co., Pacific Coast subsidiary of the U. S. Steel Corp. This plan came the nearest to meeting our requirements, as it was designed for jobs in a highly mechanized, continuous process industry. Although the basic method used in our work follows the United States Steel technique, the plan itself was worked out to meet the requirements of our particular business. We have found through past experience that methods from one plant can rarely be incorporated 100 per cent in another plant. Differences between plants, even in the same industry, require that methods be designed for each specific problem.

The first step was to decide on a list of basic factors found in the majority of jobs. The list had to include as many factors as possible to cover all types of work, yet had to be brief enough to be practical. After drawing on our personal knowledge, the opinions of the Personnel Department, the foremen and the workmen themselves, we arrived at six main divisions, further broken down into a total of fifteen subdivisions. These were felt to fairly represent the basic factors entering into most jobs.

The second step involved the numerical weighting of each factor, to represent its relative importance in the job total. This proved even more difficult than selecting the factors, as it is a problem of degree, rather than identity. However, our knowledge of the effect on cost of

* Summary of an address at a meeting of the San Francisco Chapter of the American Statistical Association on February 2, 1939.

production of certain factors helped considerably. Thus, as an example, knowing the cost of material waste in relation to the total cost of our products, gave a general indication of the importance of this factor. However, judgment was required to evaluate the degree to which this waste is controllable by the employee. The accident rate on various jobs gave us a clue as to the relative importance of this factor. Inspection records formed the basis for judging the importance of quality control. In some cases, such as mental effort, no specific measure of its importance could be found, and the weight was set purely on the basis of judgment.

Having decided on the factors to be evaluated, and the relative importance of each, the final step was to provide a series of descriptions, or bench marks, to indicate the gradations between zero and maximum for each of the fifteen factors. This was particularly necessary in our case, as several individuals were doing the work, and it was essential that the rating be comparable between members of the evaluating teams. Besides descriptions, actual jobs were listed with their ratings, serving as examples. Thus under Responsibility for Material Handled, with a maximum of 110 points, the range 30–50 was assigned to jobs with direct effect on waste or scrap on low value material. The rating was illustrated by citing the Soapstone job on #1 Machine, which rates 40 points on this factor. This was done for about five levels under each of the fifteen factors. The factors, with their weights and descriptive text, were bound in pamphlet form and formed the basis for all evaluations.

Actual rating of jobs began by selecting 3 men from the Industrial Engineering Department, allowing them to become familiar with the manual, and letting them rate the same job independently. The results, when compared, were found to diverge widely, due to different interpretations of the factors and weights. The three evaluators then discussed the differences, came to an agreement on the weights and tried rating another job. When the evaluators became trained to the point where they could agree to within plus or minus 5 per cent in 90 per cent of the trials, when rating independently, they were considered ready for the actual evaluation work.

We began by explaining the program thoroughly to the department heads and foremen. In all work of this kind we have found that it is invaluable to have the support of the supervisors and men in whose department the work is being done. Having secured the cooperation of the plant personnel, each evaluator took one-third of the plant and with the help of the foremen and department superintendents arrived

at an evaluation of each job. The finished evaluations were then checked by at least one other member of the team and any differences of opinion or fact ironed out. The point rating was then plotted on coordinate paper against the actual rate being paid. This gave a scatter diagram for each department. The data in all cases showed a definite central tendency, 90 per cent of the points falling within plus or minus 7½ per cent of the trend line. The trend lines were sketched in by eye and were not fitted by the method of least squares.

The points falling outside of the plus or minus 7½ per cent area, were restudied to see whether there was an error in the rating. If no error could be found, it was considered that the rate being paid was out of line.

Having thoroughly checked all job evaluations by individual rating, and by relationship within department, we plotted all jobs against their actual rate for the plant as a whole. This gave a scatter diagram which was a composite of the department diagrams. A straight line trend was drawn by eye, which represented the average relationship for the plant.

The trend lines by departments were compared to the trend line for the plant. In several cases remarkable differences in trend were found. Certain departments had wage scales which were uniformly above the plant average, others differed in the slope of the trend line. Further checks were made on the ratings until we were satisfied that our evaluations were uniform as between departments, and that the differences shown were real ones.

Finally, all jobs still out of line by plus or minus 7½ per cent with respect to the plant average were listed and specific recommendations made for their correction.

With the completion of the above steps we now have an evaluation, in terms of points, of every hourly paid job at the Emeryville plant. The data is valuable and useful; however, it would be a mistake to consider it as infallible. Following are a few of the weaknesses and danger points that should be considered in any use to which this data is put:

a. Are the factors chosen common to all jobs, and do they really cover all of each job's requirements? We find that in fact certain jobs such as welders and tinters are not adequately covered by this scale. Common sense and judgment, as well as the rating scale must be used in these cases to arrive at the true value of these jobs.

b. Are the weights assigned to each factor correct? There is considerable difference of opinion, for instance, as to the relative value

of responsibility as against physical effort. We rated effort low in our plant, considering that responsibility is the factor that deserves a premium.

c. Assigning of weight to factors in a specific job is a matter of judgment. Examples and bench marks help, but much is still left to the evaluator's judgment. He may be unskilled, or biased, or both. The selection of capable evaluators is very important.

d. The type of operator in the job may have an effect on the rating. A capable operator tends to enlarge his job. This can be avoided by taking care to rate the job, rather than the man.

e. The foreman or supervisor's opinion of what the job should be may affect the rating.

f. Statistical methods used are open to question.

1. Should the line be a curve? The data contained certain arbitrary factors, the effects of which were hard to eliminate. It was felt that the accuracy of the data did not warrant the use of anything but the simplest measure.
2. The fit of the line was determined by eye. Again, it is considered that the nature of the data would not justify the use of the method of least squares.
3. The use of $7\frac{1}{2}$ per cent as the determining line for job rates that should be adjusted was purely arbitrary. As the job rates are brought in line we will probably set the range closer.
4. The job points are not weighted by the number of men on each job. This should probably be done, though we know that it would not affect the conclusions appreciably.
5. The employees, or their representatives, do not take part in the evaluation work. The matter of the relative wage rate as between jobs is certainly as much a matter for collective negotiations as the specific rate for each job. The Unions, as representatives of the employees, are now consulted on matters of safety, working conditions, etc., and it is logical to consider that they could profitably be called in on this work as well. Further, if the job evaluations were a joint product of the management and the employees, the chance of misunderstanding and minor grievances would be greatly lessened.

DONALD PATTERSON,
Industrial Engineer

STATISTICAL NEWS AND NOTES

The Argentine Statistical Society

In the latter part of 1937 the establishment of the Argentine Statistical Society was proposed by a group of persons associated with the official statistical services, with the esteemed patronage of the President of the Museo Social Argentino, Dr. Thomas Amandeo. On the 25th of November of that year the Society was established as a section of the Museo Social, and on December 16th its By-Laws were adopted. On April 8th of the following year the Society elected as its President, Professor Carlos E. Dieulefait; as Vice-President, Ing. Emilio Rebuelto; as Secretary General, Sr. Octavio Luis Prud'homme; as Executive Secretary, Sr. Eliseo Catapano; as Treasurer, Sr. Miguel A. Zarini.

The Society's activities were formally inaugurated at a meeting on August 23, 1938, held at the Faculty of Exact Sciences at the University of Buenos Aires. The inaugural meeting was honored by the presence of high officials, university professors, representatives of scientific institutions, and members of the foreign diplomatic corps. The meeting was addressed by the President of the Museo Social Argentino and the President and the Vice-President of the Society. Professor Dieulefait announced the designation of His Excellency, the President of Argentina, Dr. Roberto M. Ortiz, as Honorary President of the Society, and of Frederic Zahn, Armand Julin, J. L. S. Bulhoes Carvalho, Antonin Bohac, Georges Darmois, Arthur L. Bowley, Corrado Gini, Ramón Beteta, H. W. Methorst, and M. Schellember Orloff as honorary members of the Society. Diplomas signifying their honorary membership were presented to Zahn, Bulhoes Carvalho, Bohac, Darmois, Gini, Beteta, and Methorst through the diplomatic representatives of their respective countries who were present.

The purposes of the Argentine Statistical Society include the study of the theory and applications of statistics, collaboration in the organization and coordination of official and private statistical services, and the establishment of relationships with similar organizations and with statisticians in Argentina and abroad. The Society will publish *la Revista Argentina de Estadistica*, and will maintain a library.

Dominion Bureau of Statistics, Canada

Agriculture. At the Eastern Canada Conference on the Marketing of Farm Products, held in Montreal, March 28–31, under the auspices of the Governments of Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island, and of the Chambers of Agriculture of Ontario, Quebec, and the Maritimes, the Dominion Bureau of Statistics was represented by the officers in charge of the Dairy, Fruit and Vegetable, and Live Stock Divisions of the Agricultural Statistics Branch.

External Trade. A standing interdepartmental advisory committee on statistics of external trade has been appointed. The members represent the

following departments: Finance, National Revenue, the Tariff Board, Trade and Commerce (Commercial Intelligence Service and Bureau of Statistics), and External Affairs.

Criminal Statistics. The special data on appeals in criminal cases, referred to in the report for the quarter ended January last and which were published as totals only in the *Sixty-second Annual Report of Criminal Offences*, 1937, are now being collected directly from the courts, and will be classified by nature of offence and class of court.

Motor Vehicle Retailing in Canada, 1937. During 1938 the Internal Trade Branch of the Dominion Bureau of Statistics conducted a special survey of the retail automotive trade in Canada with the purpose of obtaining authoritative figures regarding the retail sale of new and used motor vehicles in different regions of the country. Returns secured by a postal canvass from the 3,426 retail distributors show that there were 141,881 now and 271,162 motor vehicles sold in 1937, or on the average there were 1.91 used vehicles sold for every one new model. The ratio varied considerably in different regions of the country, the provincial average being highest in Ontario at 2.16 and lowest in Quebec at 1.53. This is the first time that a survey of this nature has been undertaken by the Bureau.

Nutrition and Family Living Expenditures. The Bureau of Statistics has recently undertaken a survey of nutrition and family living expenditures in Canada. The actual collection of expenditure records was preceded by a preliminary survey of certain census sub-districts in each city chosen at random in order to provide the list of families conforming to the type desired. Expenditure records were collected only from wage-earner families where husband and wife lived together with one or more children. Limits of $450 and $2,500 were established for family earnings and all families were self-supporting throughout the survey year. Field work of the survey was done for the most part by personnel with training in household economics. A staff of 90 field agents and supervisors was necessary for this purpose.

Analysis is now under way of 1,439 wage-earner family expenditure records obtained during a survey of twelve representative Canadian cities in October and November, 1938. Two schedules were used for the collection of expenditure data. On the first was recorded detailed expenditures for all items except foods for the year ended September 30, 1938. Separate food records are being collected for one week in October, 1938, and February and May, 1939. These exact weekly statements of food purchases will give an indication of seasonal differences in family food consumption. Summaries of family expenditure data have been coded and transferred to cards for purposes of mechanical tabulation. This procedure will enable an examination of expenditure patterns in relation to such factors as the number of children per family, the amount of income per person, the age of the father, tenure, the occupation of the father, etc. Cross-classification will also be possible in relation to amounts spent in various budget groups.

The food analysis will be made separately in relation to income per person and identical family records will be used for purposes of seasonal comparisons.

Division of Tax Research, U. S. Treasury Department

The Division of Tax Research of the Treasury Department is conducting an Income Tax Study Project in Philadelphia under a grant of funds obtained from the W.P.A. The data being analyzed are from the 1936 and 1937 income tax returns. Since the tax returns contain much information useful in economic analyses, an effort is being made to produce tabulations which will supplement the information tabulated for the annual volumes of *Statistics of Income* and will make available a body of valuable basic data to be used in connection with tax research, revenue estimating, and economic studies pertaining to national income, consumer purchasing power, and related fields.

There are four parts to the main study, the first being a tabulation of the sources of income and deductions reported on individual income tax returns classified by net income classes, by sex and family relationship of the taxpayers, by metropolitan areas and by cities of various size groups, and by states. The second part represents an attempt to measure family income by combining returns of husbands and wives and distributing the combined income by net income classes, by states. A cross tabulation is also provided showing the husbands' returns distributed by net income classes in relation to the wives' returns distributed on the same basis. The third part is devoted to a detailed analysis of capital gains and losses, showing gross sales volume, gross gain and losses, and statutory gains and losses cross-classified by type of assets, by period assets were held, and by net income classes. The fourth part is an analysis of income composition. Tables will be provided distributing the number of returns with one source of income, two sources, etc., by nature and size of each specific source. Similar tables will be provided for deductions.

In addition to the above-described four parts of the main study, various agencies have submitted proposals for special tabulations. These proposals involve not only the analysis of 1936–1937 data from individual tax returns but also from returns of corporations, partnerships, fiduciaries, and estates. Some of the proposals contemplate the preparation of historical tables necessitating the use of tax returns for a series of years prior to 1936 and 1937.

Several of the proposals have been adopted. They involve the preparation of tabulations which will afford considerable basic data for use in special studies of tax burden, small corporations, size and types of capital assets, and dividends.

Board of Governors of the Federal Reserve System

The Board has recently published a brief exposition entitled *The Federal Reserve System—Its Purposes and Functions*. It is a book of about 108 pages

with charts and illustrations. It is intended primarily for students, bankers, businessmen, and others who desire an authoritative statement of the purposes and functions of the Federal Reserve System. It is neither a primer nor is it an exhaustive treatise. The aim has been to have it cover the middle ground between those extremes and to make it clear and readable without neglect of essentials. The price of the book is 50 cents.

The main part of the text of the Board's *Annual Report* for 1938, which was issued at the end of January 1939, is now available in a separate pamphlet, entitled *Problems of Banking and Bank Supervision*. It contains that part of the report which dealt with problems of banking regulation and supervision under our existing banking system and with problems of credit and monetary control under conditions of large excess bank reserves. Copies of this pamphlet will be supplied upon request.

During sessions of Congress the Board of Governors is frequently asked by committees of the Senate and House to report on bills dealing with proposals for overcoming the country's economic difficulties by monetary action. Two statements have been issued recently. In the *Federal Reserve Bulletin* for April 1939 a statement on "Proposals to Maintain Prices at Fixed Levels Through Monetary Action," which had been released to the press on March 13, 1939, was published; and in the May *Bulletin* a statement, which was transmitted on April 8, 1939, to the Chairmen of the Committees on Banking and Currency of the Senate and House recommending Congressional study of monetary measures and objectives, was printed. An earlier statement on "Objectives of Monetary Policy" had appeared in the *Bulletin* for September 1937. These three statements have been reprinted in a single pamphlet, copies of which will be supplied on request.

New information in the revised reports of condition of member banks as of December 31, 1938, is analyzed in an article in the April 1939 *Federal Reserve Bulletin* showing by classes of member banks the distribution of various types of loans and of various types of investments by maturities. The new information on holdings of investments by maturities permits a better comparison to be made than has been possible heretofore of the average liquidity position of the different classes of banks, which is discussed in the article.

In 1936 statistical material to be used in a study of closed banks was collected and tabulated with funds provided by the Works Progress Administration under the supervision of members of the staff of the Board and the Reserve banks. An analysis of the material is now being made by the Division of Research and Statistics. Reports on the magnitude of presuspension withdrawals of deposits have been published in the *Federal Reserve Bulletin* for March and April, and further reports on deposit withdrawals will appear in future issues of the *Bulletin*. Other sections of the study deal with variations in the deposit balances of different economic classes in different phases of business activity, the relation of deposit balances to credits to personal deposit holders' accounts, and the size and economic composition of customer loans.

Statistics of international capital transactions of the United States for the full year 1938, and annual figures for the years 1930–1938, were published in the *Federal Reserve Bulletin* for April 1939. A new feature of the tables is the subdivision of the net movement of foreign banking funds into "central bank" and "other." Henceforth the capital movements data will be published monthly in the section of the *Bulletin* devoted to international financial statistics.

Federal Home Loan Bank Board

The Division of Research and Statistics of the Federal Home Loan Bank Board has recently undertaken a study of non-farm mortgages recorded of $20,000 or less by type of mortgagee. The first summary report was made for December 1938 and subsequent reports have been prepared in each following month. The information is collected on a standard schedule form prepared by the Division, and the reports are sent in each month by cooperating savings and loan associations who collect the original mortgage statistics for their counties, from either the recorder of deeds and mortgages or from legal or credit bulletins covering legal activities in the county. Reports were received in December from communities possessing 22 per cent of the non-farm population of the country. This coverage increased to 38 per cent in January and 43 per cent in February. Present indications reveal an increased coverage for the month of March. The completed reports are in the form of a mortgage recording letter presenting analytical comments and graphs, which is sent to all respondents and is also available for general distribution. The report also includes a United States table showing mortgage activity by type of lender in each state. This table is also available for distribution. In some areas we do not have certain important communities covered by any cooperating agency, but through the facilities of the Mortgage Bankers Association, the United States Building and Loan League and the National Title Association, through whose cooperation this study is being made, it is expected that additional cooperating respondents will be secured.

It is recognized that certain deficiencies exist in this study, but there is no possibility of segregating refinancing activity from new mortgage business. Moreover, in the instance of any recasting of mortgages, the full amount of the instrument is recorded rather than merely the increase which occurs in the mortgage. In addition, there are undoubtedly some uncertainties existing in the classification of mortgagees under the several categories established in this report. There is also the possibility that the $20,000 limit established for the purpose of providing information essentially covering the field of home mortgage finance permits the inclusion of some mortgages on other than residential property. Recognizing these limitations, it is the feeling of this Division, and the expressed opinions of leading savings and loan executives bear it out, that the summary report accurately reflects the extent to which different mortgagees are participating in the home mortgage market.

The indexes of the cost of building a standard six-room frame house have been revised to a full year 1936 base as 100 per cent, and index numbers are available by months for material, labor, and total cost covering the period January 1936 to date.

Bureau of Foreign and Domestic Commerce

Supplementing its regular work in the field of national income, the Division of Economic Research has released for the first time estimates of income payments in the various states. These estimates provide detailed statistics by type of payment and cover the years 1929 through 1937. Preparation of current estimates will be continued as a regular function of the Division. Data have been recently compiled on the incomes of dentists and osteopathic physicians for selected years from 1929 through 1937.

A study of the fluctuations in residential building, using multiple correlation techniques, has recently been made by this Division for the National Resources Committee. The report evaluates the factors influencing the volume of residential building, and in a separate section analyzes the factors determining residential rents. It makes available new estimates of the number of families which may be expected in the United States during each 5-year period through 1960 and includes other entirely new series relating to residential building activity and to annual increments in the number of families in the United States since 1900. The annual estimates of long-term debt in the United States have recently been revived, and it is the intention to issue these figures regularly each year in the future.

The Finance Division has completed a study of the status of American investments in foreign dollar bonds. For the first time the net United States holdings of foreign dollar bonds and the extent of the repatriations of those obligations are shown by countries. The study brings up to date estimates of the interest default status of foreign dollar bonds still held in this country, and the amount of income received from American holdings of foreign dollar bonds. The Division is bringing to completion an analysis of travel between the United States and oversea countries. The study covers a period of 100 years and includes data relating to the number of tourists as well as the payments involved.

The Division of Foreign Trade Statistics announces that a complete scrutiny of both export and import tabulations for apparent errors prior to the first release of foreign trade figures has been made possible in recent months. By completing this review of the monthly tabulations, all apparent inconsistencies are investigated and the corrections carried to the original machine run. The revised figures are thus incorporated in the first foreign trade press release, and are available on the 25th of the month for the previous month's foreign trade. It is planned to inaugurate additional verification of the original coding and punching for those commodities, and for those documents, where errors occur most frequently. It is expected that improved methods of tabulation procedure will expedite the publication of

the annual figures in *Foreign Commerce and Navigation* for 1938 several months earlier than in recent years.

The Annual Review Number of the *Survey of Current Business* was published in February, thus providing the Department's review of economic conditions for the calendar year earlier than has been possible in other recent years. The Division of Business Review has released a series of reports on United States trade with leading foreign countries in 1938, which provide an analysis of the trade movement with leading markets. *Foreign Trade of the United States in the Calendar Year 1938* will be published this year in two parts, the first of which is now available. Part I contains the data given in the *Summary of United States Trade with World* issued from 1931 to 1937, inclusive, and certain data formerly shown in *Foreign Trade of the United States in the Calendar Year* issued from 1922 through 1926. Part II, which will be available in July or August, will cover the commodity trade by countries.

Work is progressing on the *Industrial Market Data Handbook*, which is being compiled in the Marketing Research Division. This publication, which is expected to be available in July, will contain data on industrial production, employment, value of products and cost of materials, by counties, and for cities having a population of 10,000 or over. The study will include like information for 280 manufacturing industries on a national basis, and the county location of 169,111 manufacturing plants, by industries. It contains a county location table for 23,000 mines, and summary data on production and employment in the mines, by counties. The Bureau of the Census and the Bureau of Mines have cooperated in the compilation of this *Handbook*.

The *Consumer Market Data Handbook, 1939*, is now available. This volume contains a somewhat more exhaustive treatment of statistical material than has heretofore been presented. Thus, it presents 82 series of data, over one-third of which have not previously been published. The data are shown by counties, and for all cities having a population of 2,500 or more. The selection of the statistical series was on the basis of their usefulness in analyzing markets on a county basis, as determined from the results of a questionnaire sent to advertisers, distributors, and other business men.

Suggestions for use in *Making a City Survey* (Industrial and Commercial), another recent publication of this Division, develops a basic outline of the technique of initiating a survey in any city or region. The outline is comprehensive and flexible enough to be useful not only in industrial and commercial surveys, but also in market analyses, factory location surveys, real estate appraisals, local purchasing power analyses, and studies of general business conditions.

The Secretary of Commerce has indicated his interest in current plans of the Conference of State University Schools of Business to develop a plan of cooperative business and economic research with the Department of Commerce and the various state universities or other state educational institutions participating. In a letter dated April 1 to the Honorable Clarence F.

Lea, Chairman of the House Committee on Interstate and Foreign Commerce, the Secretary gave his full support to the proposed amended Bill (S 1740—H.R. 3395). The Bill is directed particularly to the needs of small business enterprises, and it has been modeled as closely as possible on the existing legislation which provides similar research facilities for the benefit of farmers. Suggested studies under the authority of this Bill include simplified accounting methods, consumer demand, price and market trends, trading areas, taxation, store location, state income studies, local building codes, capital requirements, and production, distribution, and marketing techniques.

United States Tariff Commission

A "Compilation of Data on United States Trade with Germany" was issued by the Commission in multilith form in April 1939. This document consists principally of a series of tables, one for each of the 264 commodities of which imports from Germany or Austria were valued at $50,000 or more in 1937. Imports are shown from all countries, from Germany, and from Austria, for the years 1929, 1931, and 1934 to 1938 inclusive, and from the other principal sources in 1937. Copies may be obtained on request from the United States Tariff Commission, Washington, D. C.

The Tariff Commission-W.P.A. Statistical Project in Richmond has just begun a tabulation of imports for consumption of commodities with respect to which concessions have been made in trade agreements. The imports, for the years 1937 and 1938, will be arranged to show, for each commodity, tariff paragraphs, statistical class numbers, rates of duty before and after the trade agreement changes, quantities and values, and countries of origin. Owing to the numerous requests that have been received for information of this character, it is probable that a summarization will be published on completion.

The staff at Richmond is also engaged in making an analysis of 1937 imports in the so-called "basket clauses" of the tariff act. Under these clauses such as "chemical elements, compounds, mixtures, and salts, not specially provided for" and "fresh vegetables, not specially provided for," to mention only two, are dutiable a large variety of products. The present analysis of invoices will identify and gauge the relative importance of the commodities entered in these residual groups. While this work is being done primarily for the use of the Commission, the results may be made available for consultation by interested persons.

An analysis of informal entries by parcel post, those valued at less than $100, is being made by the Richmond project for the last quarter of 1937. No study of this kind has been made before.

Commodity Exchange Administration

The Commodity Exchange Administration has started a study of the trading in Chicago grain futures by the customers of a large futures commis-

sion and brokerage house during the years from 1924 to 1932 inclusive. It is believed that the trading through this house was a representative sample of grain futures trading during this period and that the study will result in much more accurate information on the nature of trading done by small and medium-sized speculators than has been available heretofore. As well as showing how the general public trades on an organized market, it should indicate the effects of such trading on the finances of the traders and on the market. It is expected that significant information will be secured on the characteristics of trading by the outside public during price swings, and that it will be possible to reach conclusions as to whether such trading accentuates or diminishes such swings.

Dr. Holbrook Working, of the Food Research Institute of Stanford University, is being employed by the Commodity Exchange Administration as a consultant in this investigation.

Bureau of Agricultural Economics

In analyzing poultry prices, the Division of Statistical and Historical Research has recently begun to test the variables used in correlation analyses for homogeneity. The test used is based on standard methods, but, so far as is known, little use of it has been made in testing agricultural time series. The variance of the means of groups of four consecutive time units in a time series is tested for homogeneity by the standard methods of analysis of variance. The variance of the standard deviations of these groups is tested by comparing the actual variance of the group standard deviations with the estimated variance, computed from the standard deviation of the sample as a whole. In each case the F test is used to determine whether the group means and group standard deviations vary more than would be expected by random sampling from a homogeneous population. In the poultry price work the method has been applied largely to time series which have been transformed into first difference logarithms. Production series appear to be more homogenous than do price series, although there is much variation in results between different variables for each type of series.

An article, "Crop Estimating—An Appraisal," by Charles F. Sarle appears in the May issue of the *Agricultural Situation*, published by the U. S. Department of Agriculture. It is the first of three articles setting forth in brief fashion the methods used by the Department in making official estimates, pointing out their limitations from a statistical standpoint and suggesting methods for improvement. This first article deals with annual estimates of acreage, yield per acre, and production of crops. The problem of forecasting the production of crops prior to harvest will be discussed in the June issue, and the estimates of livestock numbers and production in the July.

Bureau of Labor Statistics, U. S. Department of Labor

The Bureau's wholesale prices of Portland cement have recently been revised. The new series, based on delivered prices at 48 cities, replaces the

former series which was based on an average of maximum mill prices at 6 plants. The new indexes are available by years from 1926 through 1938 and by months from January 1933 through March 1938. The series are based on prices to dealers as reported by manufacturers. Prices are per barrel, gross in cloth, with the cost of the package and trade and cash discounts excluded, and are in carlot quantities f.o.b. cars' destination at the 48 cities. In constructing the index, the price at each city was weighted by the estimated consumation of cement in the area considered to be represented by the price at that city. The base period used (1926) and the general procedure in constructing the index numbers are those which have been employed by the Bureau since the general revision of its wholesale price indexes in 1931. The revised series for chemicals and drugs will be issued early in the summer, and will cover chemicals, fertilizer materials and mixed fertilizers, drugs and pharmaceuticals. Preliminary work has been done on the revision of the hosiery and work clothing prices.

By act of Congress, the Bureau of Labor Statistics is ordered to make periodic studies of social and economic conditions in Hawaii. The last survey was made in 1930, and another is now under way. Professor James H. Shoemaker of the economics faculty of Brown University is on leave of absence to supervise the study for the Bureau. The report will be available in the fall.

The quarterly Cost of Living index has been revised on the basis of the study of expenditures of wage earners and lower-salaried clerical workers made in 1935 and 1936. The kinds and number of items priced have been modified and new weights are employed. Better specifications will result in more comparable prices from period to period. A different list of commodities is priced in each of 8 geographic regions, the goods and services priced being determined on the basis of the consumption study. The June index is the first to be computed on the new basis.

The reports from the study of consumer purchases prepared by the Bureau of Labor Statistics are being issued in 4 series: 7 regional bulletins on income, 7 regional bulletins summarizing consumer expenditures, 8 presenting tables on the details of expenditures, and 8 analyzing the shifts in expenditure with increases in income, in the different regions covered in the investigation. The results of the study of expenditures of wage earners will appear in 7 regional bulletins and one presenting United States averages.

A study of "labor patterns" on different types of public construction projects has been undertaken. There will be an analysis, by type of construction, to show the time elapsed between the approval of the project by the public agency and the award of the contract, between the awarding of the contract and the time when material orders are placed and work starts, and between the date when work starts and the completion of the project. The stage when employment and payrolls reach their peak will also be determined. The study will be useful in the planning of public works, in that it will show when the contracts have their maximum effect on the labor and

when industries feel the effect of orders placed. A preliminary analysis will be made of 300 projects.

Reports are available for some of the larger cities covered in the Building Permits Survey, showing for 1936–1938 the number of residential and non-residential permits by cost groups, and type of material and structure. This survey supplements the study recently completed for the years 1929–1935.

As part of its studies of the relationship of site labor to primary indirect labor on P.W.A. projects, a survey is under way to show (1) the amount of labor created in sponsor's offices including representatives such as engineers, architects, and lawyers for (a) preparing applications, plans and specifications, and rendering legal services prior to the awarding of the contracts and (b) supervisory labor on the job; (2) the amount of labor in contractors' offices prior to the time work starts at the site, or other labor not now reported as site labor. The study will be made on a stratified sample basis, taking into consideration such factors as type of construction, size of project, geographic location and size of community.

Field work has been begun on surveys of wages, hours, and working conditions in the lumber industry and the hat industry. Other studies under way include foundries and machine shops, boots and shoes, and apparel. Significant data on annual earnings are being made available through these wage and hour surveys. The improved records being kept by employers in connection with reports for the Social Security Board have made it possible to secure increasingly better reports on annual earnings, and in some industries it is possible to analyze the data by occupation, degree of skill, and sex, and to show separate earnings figures for full and part-time workers. Special reports on annual earnings will be prepared for iron and steel; radios; electrical apparatus and supplies; hosiery; underwear, outerwear and knit cloth; and meat packing.

Beginning with the retail price reports for March, new specifications were used for canned goods. Salad dressing has been added to the list of foods priced. Labor turnover reports for the paper and pulp industry are now published monthly, bringing to 28 the total number of industries for which individual rates are computed.

The monthly reports on employment and payrolls have been tabulated by machine for a number of years. Until recently, however, the transcription of the data from the schedules to permanent office records cards, and the editing of figures for pay periods longer than one week to an equivalent weekly basis were done by hand. The machine punching was then done from the transcribed cards. Under the new procedure, the data are punched directly from the schedules, a multiplying machine edits the data to a weekly basis, and the office record cards are printed from the punched cards by a machine with a billing attachment.

Two studies of labor law have been brought to date and are available in mimeographed form. They deal with the payment of wages in scrip, company stores and traders, and with state full-crew laws.

Women's Bureau, U. S. Department of Labor

Two important field surveys have been inaugurated recently. The first, undertaken at the request of the Wage and Hour Division, is a nation-wide survey of the women's, infants', and children's apparel industries, to secure the current wages and hours for use by the special committee appointed for these industries. Approximately 1,500 establishments will be visited. The other survey is a study of women workers' personal and family responsibilities, with the purpose of determining their contribution to the national economy in service outside the home and their contribution to the family in income and service within the home. The inquiries will include kind and tenure of employment at various ages; the factors determining changes; the conditions and obstacles met today as compared to 10, 20, or 30 years ago; the family's economic status in relation to the woman's contribution; and home conditions and problems. A cross section will be taken not only of classified age groups but of the major industry and service groups. The cities visited will be representative of the various parts of the country and of various economic demands.

Children's Bureau, U. S. Department of Labor

In cooperation with Community Chests and Councils, Inc. the Division of Statistical Research of the Children's Bureau has undertaken an analysis of expenditures for health and welfare programs in the various cities included in the project for the registration of social statistics.

Thirty cities have agreed to supply this information in time for publication in June. The material being secured applies to the year 1938, and will indicate the total and per capita expenditures for health and welfare programs, the cost of the various specialized activities, and the sources from which funds are secured. Certain annual material regarding case loads and other service data will also be secured in the child welfare and family welfare fields. The service data being collected in the two above-mentioned fields will make possible the comparison of several measures of the volume of welfare work.

With the advice and help of its Advisory Committee on Current Statistics, statistical supervisors from the reporting areas, and a number of national agencies, the Division of Statistical Research has completed a review of the schedules used in connection with the registration area for the monthly reporting of social statistics. The review resulted in moderate or substantial revision of 17 of the 22 schedules used in connection with this project. Most of the revisions were in the direction of simplification and condensation. Among the 17 schedules revised, there was effected a net reduction of about one-third in the items to be reported. Copies of the revised schedules and instructions may be secured from the Bureau.

Office of Education

Rapid progress is being made on the chapters of the Biennial Survey of Education for 1937–38. A report will be received for every public high school

in from one-half to three-fourths of the states and for nearly every high school in the other states. The public high school chapter will probably go to the Printing Office in July, other chapters following as completed.

In the library statistics, the form for data for college and university libraries has gone to press and data will be collected in the fall of 1939. This is the third study in the series, statistics on public school libraries being available now and those for public libraries are in process of collection and tabulation.

A study is being made of the effect of the temporarily lowered postage rate on books to show the savings on postage which librarians may invest in additional books.

Bureau of Research and Statistics, Social Security Board

The second national conference of directors of research and statistics in State public welfare agencies, which was originally announced for May, will be held at the Mayflower Hotel in Washington October 23–26. A Committee of State statisticians will assist in planning the conference. The majority of the meetings will be devoted to group discussions of ways of making statistical data of greater value for administrative use and public information.

Beginning with the March issue of the *Social Security Bulletin*, the statistical series on all public relief in the continental United States were revised. In addition to data on employment and earnings of persons certified as in need of relief, the series now include data on employment and earnings of all other persons employed on work and construction projects financed in whole or part from Federal funds. Heretofore, these series have been limited to public aid granted on the basis of need but after careful consideration of the problems involved, the Joint Committee on Relief Statistics of the American Statistical Association and American Public Welfare Association concluded that a more adequate measure of the total effort to provide relief and a more comparable set of data would be secured by the inclusion of all employment and earnings on projects financed in whole or in part from Federal funds. Revised data from January 1937 through December 1938 are presented in the March issue of the *Social Security Bulletin* and revisions extending back to January 1933 will be published in the April issue. State series for January 1939, comparable in content to the revised series for the continental United States, also will appear in the April *Bulletin*.

The Division of Public Assistance Research has made preliminary plans for the collection of statistics on the causes of blindness of recipients of aid to the blind in States with plans approved by the Social Security Board. These plans have been developed with the advice of members of the Committee on Statistics of the Blind and with the assistance of the Consultant on medical problems of the Bureau of Public Assistance and the Chief of the Division of Standards and Procedures of that Bureau. Data will be collected on age, sex, race or color, residence, degree of blindness, age at onset of blindness, and the etiological and topographical causes of blindness.

The classification of the causes of blindness to be used is that developed by the Committee on Statistics of the Blind which is sponsored jointly by the American Foundation for the Blind and the National Society for the Prevention of Blindness. Data will be collected only from those States which are interested in participating in the project on a voluntary basis and which have eye examination records sufficiently complete and of good enough quality to make the statistics of value. It is believed that statistics collected in this experimental project will constitute the most comprehensive and reliable data on the causes of blindness that have so far been available in this country.

Four articles of the series on social characteristics of recipients accepted for public assistance during the ficsal year 1937–38, based on annual reports submitted by State agencies administering public assistance under the Social Security Act, have appeared in recent issues of the *Social Security Bulletin*. The March issue of the *Bulletin* contains data on the physical condition and medical care of old-age assistance recipients and, in the near future, an article on age, race, and nativity, the last of the series on old-age assistance, will be published. A series of articles presenting data on aid to dependent children will next appear in the *Bulletin*.

The Division of Health Studies has completed a number of preliminary estimates of probable volume of disability among the estimated number of gainfully occupied workers in the United States and among those now covered under the provisions of the Social Security Act. These estimates are based on disability experience of various European social insurance schemes, with appropriate modifications, and of certain American sources (National Health Survey, Civil Service, Veterans Administration, private insurance companies, and certain municipal and State disability compensation schemes). A systematic analysis is being conducted at the present time to determine incidence and volume of disability resulting from disabling sickness of specified duration not in an excess of one year.

The Division is supervising a W.P.A. project at Richmond, Virginia, to analyze family composition in the United States. The project is utilizing the schedules from the National Health Survey conducted by the U. S. Public Health Service. It is anticipated that some of the results will be made available in a series of articles in the *Social Security Bulletin*, starting with the issue for April 1939.

The Division of Old-Age Benefits Research, in collaboration with the Analysis Division of the Bureau of Old-Age Insurance and the Office of the Actuary, has devoted the major part of its activities to the various proposals for amending the Old-Age Insurance program which are now being considered by the Ways and Means Committee of the House. These studies include estimates of the numbers of persons to be affected by the Board's recommendations for extended coverage. Attempts were also made to estimate future taxable pay rolls and tax receipts under title VIII and to reconcile these figures with the taxable pay rolls under unemployment compensation. In addition to its regular functions of reporting and interpreting financial

and other related data, the Division prepared an analysis of the 1940 Budget estimates with special reference to tax receipts and the growth of trust funds under the Social Security Act.

Research projects in the Division of Economic Studies have centered largely on the study of the economic resources of the States in relation to their public welfare needs. Under present public assistance and relief structures it appears that there are wide differences in the degree of aid given to individuals in similar need but residing in different States. In order to determine the reasons for this variation, to judge the desirability of adjusting the Federal allocation of funds to meet the problem, and, if such desirability is assumed, to determine upon its feasibility, several lines of research have been inaugurated to converge toward a general basis of judgment concerning differences among States in the capacity to finance their welfare needs. The recent hearings before the Senate Committee on Unemployment and Relief and before the House Ways and Means Committee on the subject of amendments to the Social Security Act have focused attention on the use of State per capita income statistics as a basis for distributing variable grants-in-aid to the States. Research is being done upon problems and methods of using State income, and other measures based upon income but adjusted by related factors, as a basis for allocation of Federal grants-in-aid.

Bureau of Old-Age Insurance, Social Security Board

A tabulation of data from the 1937 wage records of approximately 30.5 million employees, who earned taxable wages in jobs covered by title VIII of the Social Security Act, has been completed. Tables presenting distributions of employees and their wages by State of employment, age, sex, race and interval of earnings, have been prepared and multilithed. Additional tables showing the interstate migratory flow of these employees are now being compiled. Persons interested in obtaining copies of the multilithed tables should address their requests to Merrill G. Murray, Assistant Director, Bureau of Old-Age Insurance, Social Security Board, Washington, D. C. A series of articles interpreting this material is being published currently in the *Social Security Bulletin*.

Plans are being developed for a similar tabulation of 1938 data, which will provide additional information with reference to the industrial distribution of employees, the continuity of individual employment within the year, and the turnover within each reporting period. It is hoped that this tabulation will be completed by the end of the present calendar year.

The employer tabulation for the first quarter of 1938 has been completed. This tabulation provides information on the number of employers, the number of wage reports, the amount of wages reported, and the number of employees on the last pay roll of the quarter. Tables showing distributions of these items by States, size of cities, class, industry and size of firm, are being prepared and should be available within a few weeks. Returns from employers having more than one establishment in more than one industry or

more than one locality are made from the concerns' headquarters. It is necessary, therefore, to make adjustments in the statistics for such employers to permit geographical and industrial distributions of employees and pay roll. Work on the tabulations of employer data for the other three reporting periods of 1937 are now in process, and when completed they will provide similar distributions as those which have been compiled for the first quarter.

Vital and substantive data pertaining to wage earners for whom social security claims were filed in 1938 and 1939 have been transcribed and coded for 125,000 claims. The Bureau of the Census Occupation and Industry Code has been added in 50,000 cases.

It is anticipated that the 1938 claims and the 1939 claims certified to the Secretary of the Treasury for payment through June, will be transcribed, coded and punched by the early part of July. Tables will be compiled from these data and will be completed by September 1, 1939.

The Bureau of Old-Age Insurance has designed a special form to furnish the Bureau with a prompt notification and proof of death of the holders of account numbers issued under the old-age insurance program. This form was approved by the American Public Health Association and the American Association of State Registration Executives. With the cooperation of the registration officials of the State of Maryland, a test study of the use of this form is being conducted in certain selected counties in that State. This form will be useful for administrative purposes, but also will facilitate the coordination of vital statistics data secured by the Bureau of Old-Age Insurance with vital statistics data gathered by the Vital Statistics Division of the Bureau of the Census.

United States Employment Service

The results of a cross-section analysis of the job-seekers registered with offices of the United States Employment Service in April 1938 and an account of the operations of the public employment offices during the period in which unemployment compensation benefit payments were started are contained in a recently completed publication of the Employment Service, *Survey of Employment Service Information*. The survey presents summary information concerning trends in applications, placements, and active file from September 1934 through December 1938, with more complete information concerning the data for the last two years. Comparative reports of operations in benefit- and non-benefit-paying states are given and Employment Service data are compared with other series in selected geographic areas. Particular emphasis is paid to the identification of certain groups of recession and non-recession unemployed.

Following the complete inventory of the active file of April 1938 a sample inventory was made in August based upon the records for seven representative states and the District of Columbia. Results of this survey are discussed in the April 1939 issue of the *Monthly Labor Review*.

Studies are being conducted into the question of changes in the total labor

supply of the country for the next five years. Some preliminary findings of these studies have been summarized in a mimeographed report. This report gives a brief discussion of the methods used in preparing the estimates and comments briefly upon the applicability of the methods for labor supply forecasts in local areas.

A study of the operations of public employment offices for veterans is now being completed. This is based upon operating records available through February 1939 and should be of interest not only to persons directly interested in the veteran group as such but also to those concerned with the chances of placement of men over forty. A similar analysis of general placement activities of the Employment Service for applicants as a whole is now being prepared.

In connection with the investigation of methods to aid in estimating clerical potentialities of workers in selected occupations the Worker Analysis Section has completed studies of 771 clerical workers distributed among 12 samples. These studies have resulted in the formulation of preliminary test batteries with reference to the occupations of adding machine operator, bookkeeping machine operator, calculating machine operator, card punch machine operator, coding clerk, comptometer operator, and hand transcriber.

In addition to standardizing such preliminary test batteries for specific clerical occupations a battery has been developed for estimating general clerical potentiality as represented by the foregoing occupations. This work was carried on in connection with the program of developing occupational counseling techniques for families of similar occupations.

Similar work on other clerical occupations has been started on samples of pen and ink bookkeeping workers, typists, stenographers, phonographers, index clerks, and order fillers. At a later date results of these studies will be used to refine the preliminary general clerical battery.

Division of Research, Works Progress Administration

Unemployment Surveys. A follow-up study of the Survey of the Labor Market is being conducted which will secure information on income, relief experience, and receipt of unemployment compensation for a sample of 2,000–2,500 families in two cities, San Francisco, California, and Birmingham, Alabama, in which the Survey of the Labor Market has been conducted. The results of this survey will be used to supplement data secured by the Survey of Unemployment Without Public Aid. In cooperation with the Industrial Research Department of the University of Pennsylvania, a special survey was conducted in Philadelphia to ascertain the extent of unemployment in a cross section of the population and the extent of need among families containing unemployed workers.

Depressed Areas. As a result of the survey to determine and analyze the nature and causes of protracted economic dislocation, the first of several

brief descriptive memoranda on the seven cities in the coal mining area of Southern Illinois has been released. In connection with these surveys, a number of standard statistical series have been compiled for Southern Illinois and for New Bedford, Massachusetts, indicating long-run trends in production, wages, industrial capitalization, size of enterprise, tax levies and collections, savings, liquidations, population mobility, mortality, and public and private relief.

Study of Hourly Wage Rates. Hourly wage rates paid in the construction industry during 1938 have been collected for 1,415 communities throughout the country. The data cover wages paid in 24 occupations in the skilled, semi-skilled, and unskilled groups and include rates paid by private associations and contractors and by public organizations to both union and non-union construction workers.

Youth in Agricultural Villages. The analysis of the data collected in the survey of youth in 45 agricultural villages, conducted by this Division in cooperation with the American Youth Commission and the Columbia University Council for Research in the Social Sciences, is nearing completion. The report will contain sections on the personal characteristics of the youth, the mobility of village youth, school attendance and educational attainment, employment of village youth, occupations of village youth, property ownership and income, and social and recreational activities. An appendix gives the relation of the youth group to the total village population.

Survey of Migratory Workers in Crystal City, Texas. This survey was conducted for the purpose of collecting data on employment histories and relief experiences of migratory spinach workers in Crystal City, Texas. Information as to the demand for migratory workers, recruitment, supply of workers, wage scales, and living conditions was secured in order to determine the factors responsible for depressed conditions in the spinach industry in Texas.

Index of Research Projects. Volume III of the *Index of Research Projects* which is in preparation will include digests of research projects undertaken under the auspices of the WPA on which final reports were made available subsequent to June 1937. It will also include summaries of the reports based upon the Federal Emergency Relief Administration and Works Progress Administration Cooperative Rural Research plan. Volume II, covering research undertaken by public planning organizations, has been released.

Municipal Finance. Analysis is being made of State and local financial data on budgets, revenues and expenditures in order to determine trends of such data and their relation to the financing of relief and public assistance costs. Special attention is given to level of sponsors' contributions to the WPA program in relation to local budgets and revenue data. Such analyses have recently been made for Flint and Detroit, Michigan, Cleveland and Toledo, Ohio, and a number of other localities in Oklahoma, South Dakota, and Indiana. Tables have been compiled presenting current information on debt, tax collections, expenditures, and relief costs of State and local governments.

Division of Statistics, Works Progress Administration

A new monthly series on total amounts of public relief payments and earnings on Federal work and construction projects for the period beginning with January 1933 has been published by program in the *Analysis of Relief and Employment on Federal Work and Construction Projects* for January 1939 and will be continued for subsequent months. These figures do not include earnings of administrative employees and are comparable to the series on the net total number of households and persons aided under the various public relief and employment programs which are also shown in this release.

The national summary of physical accomplishments on all WPA projects completed during the period July 1, 1935, through June 30, 1938, derived from individual reports for about 200,000 projects was completed early in April. All of the state reports have now been issued. These tabulations show in detail the material benefits that have accrued to the various communities in the nation through the operation of WPA projects. The reports contain information in appropriate units of measurement on the construction or improvement of public buildings, roads and streets, airports, recreational facilities, water supply and sanitation systems, drainage and flood and erosion control, as well as conservation work, sewing room production, white collar and professional work, commodity distribution and many other items.

A review of the need of all certified workers employed on WPA projects February 15 to March 15, 1939, has been made in accordance with Public Resolution No. 1 of the 76th Congress. In connection with this review, schedules were prepared containing information concerning the financial resources of each worker. Additional information from the individual earnings records with reference to duration of WPA employment was recorded on the schedules. These schedules provide a number of items of social data which have never been obtained previously for WPA workers.

Data showing duration of last continuous WPA employment are being classified according to size of family and the age and race, and the security wage classification of the worker as well as by size of the community.

The results of a special study of the occupations at which workers were employed on WPA projects in November 1937 were published in April. This study includes data on the assigned occupations of WPA workers according to the types of projects on which they were employed, by sex and by states. The occupational classification is generally comparable to census practice although some of the groupings were modified to fit the kinds of jobs provided on the work program.

Tables and explanatory text summarizing activities of the Emergency Work Relief Program of the Federal Emergency Relief Administration were released in April. The tables show for various types of projects, the number of projects operated in the continental United States and the amount expended for earnings, materials, and other project costs. Amounts expended from State and local funds and from funds granted to the States by the FERA are also shown by States for each type of project.

National Bureau of Economic Research, Inc.

The Annual Report for 1938, *The National Bureau Enters Its Twentieth Year*, announces several changes in the Board of Directors. A. H. Williams, Dean of the Wharton School, University of Pennsylvania, has succeeded Joseph H. Willits, who resigned when he became Director for the Social Sciences in The Rockefeller Foundation. H. M. Groves replaces the late Harry Jerome as representative of the University of Wisconsin. Edmund E. Day, President of Cornell University, is the third new member to be added as a result of the decision by the Board to extend the representation of universities.

The Conference on Research in National Income and Wealth held its annual meeting on April 21 and 22 at the National Bureau. About 60 people from over 30 agencies attended. The following papers, which had been circulated in advance, were discussed: R. W. Goldschmidt, "Volume and Components of Saving in the United States, 1933–1937;" Charles L. Merwin, Jr., "American Studies of the Distribution of Wealth and Income by Size;" R. R. Nathan, "Some Problems Involved in Allocating Incomes by States;" Charles Stewart, "Income Capitalization as a Method of Estimating Distribution of Wealth by Size Groups;" Clark Warburton, "Three Estimates of the Value of the Nation's Output of Commodities and Services—A Comparison;" P. H. Wueller, "Income and the Measurement of the Relative Capacities of the States." These, together with the discussion, will be submitted to the Directors of the National Bureau with the request that they be published as Volume III of *Studies in Income and Wealth*. The Executive Committee for 1939–40 comprises: Simon Kuznets, Chairman; M. A. Copeland, W. L. Crum, Hildegarde Kneeland, H. M. Groves, R. R. Nathan, O. C. Stine, and Milton Friedman, Secretary.

The Committee on Research in Finance is forming an Advisory Conference of specialists from academic organizations, government agencies, various branches of banking, industry, trade, and labor, under the chairmanship of T. Jefferson Coolidge of the Old Colony Trust Company of Boston. The purpose is to utilize their experience in carrying out projects and in shaping the long-range research program. F. Cyril James, of the University of Pennsylvania, is Secretary.

A quantitative investigation of the investment experience, market prices and yields of each railroad, public utility, and industrial bond issued from 1900 to 1938 has been started under the financial research program. The Board of Governors of the Federal Reserve System, the Central Statistical Board, the Comptroller of the Currency, the Interstate Commerce Commission, the Federal Deposit Insurance Corporation, the Securities and Exchange Commission, and four financial advisory services—Fitch Investors Service, Moody's Investors Service, Poor's Publishing Company, and Standard Statistics Company—are cooperating with the National Bureau in planning and supervision. Winfield W. Riefler is chairman of the committee immediately in charge and Melvin W. Brethouwer is Project Director.

Committee on Cost-Price Relationships of the Conference on Price Research

The Conference on Price Research has created a new standing committee on cost-price relationships. The principal objectives of this committee are: (1) formulation of research problems in the field; (2) clarification of concepts and terminology; (3) improvement of data; (4) improvement of methods of research; (5) initiation and stimulation of research.

In the preparation of a unified program of important and practicable price-cost research projects, the committee is examining critically a comprehensive list of problems in order to appraise the significance of each for economic analysis and for business administration and to determine its feasibility for immediate investigation.

The committee hopes also to be of assistance in the clarification of concepts and standardization of terminology so urgently needed if integration of economic theory, accounting procedure, and administrative practice is to be achieved. Lack of agreement on the meaning of terms lies at the root of much confusion in the discussion of cost-price relationships and impedes cooperation among accountants, economists, and business executives.

In working toward improvement of data this group plans to survey published cost material, appraise the adequacy of the information provided by cost accounts for the study of cost-price relationships, and use its influence to make the cost data of private enterprise available to investigators. The committee, therefore, hopes to examine the data with a view to framing cost-price research projects that are adapted to the available information and to improving and standardizing accounting data in order to make it more suitable for answering the questions economists and executives ask.

In attempting to improve methodology, the committee has begun an inventory of published research and has commissioned its staff assistant to prepare a monograph on methods of analyzing the behavior of the short-run costs of individual firms.

The committee hopes to stimulate and coordinate research in cost-price relationships as well as to initiate and supervise certain projects of its own. With this in view, it is hoped that persons interested and active in cost-price research will help this group keep in touch with research currently in progress.

The members of the committee are: Professor Edward Mason, Chairman, Harvard University; Mr. C. M. Armstrong; Professor J. M. Clark, Columbia University; Dr. Joel Dean, National Bureau of Economic Research; Mr. C. Oliver Wellington, McKinsey, Wellington & Co.; Dr. R. H. Whitman, R. H. Macy & Co., Inc.; Dr. Theodore O. Yntema, University of Chicago. Communications should be addressed to Joel Dean at the National Bureau of Economic Research, 1819 Broadway, New York City.

National Industrial Conference Board, Inc.

In the Management Research Division of The Conference Board, F. Beatrice Brower is working on a "Study of Pension Plans in Industry which

Supplement the Social Security Act." Miss Brower is also collaborating with Professor Herman Feldman of Dartmouth on an analysis of "Plans for Stabilizing Employment."

This division is also at work on the following studies: "Methods of Wage Payment," by E. S. Horning; "Medical Service in Industry," by C. E. Payne; and "Prevalence of Industrial Relations Activity in Industry."

In the Economic Research Division of The Conference Board, the following projects are under way or have been completed and await publication.

1. Dr. L. H. Kimmel has made a detailed study of credit facilities which will be published shortly under the title "The Availability of Bank Credit, 1933–1938."

2. The statistical bases of The Conference Board's Indexes of Manufacturers' Inventories which were first announced in March after more than a year of research are being extended to include reports direct from a large number of important companies.

3. The Board is making progress with an inquiry, under the supervision of Dr. Roland P. Falkner, into the national wealth of the United States, according to the categories of wealth specified in the last official estimate of the Bureau of the Census in 1922. The more abundant statistical data now available will it is believed permit more accurate estimates than were formerly possible. When completed there will be an estimate of total wealth and its several categories for each year from 1922 to 1936, together with estimates of total wealth for each of these years for the individual states.

4. Dr. Jules Backman has recently completed several studies on various aspects of price movements: "Price Uniformity," "Recent Experiments in Government Price Control," and "Price Flexibility and Inflexibility."

5. Work is proceeding on studies of national income in the various states and in certain industrial sub-groups. A detailed study of the distribution of family and personal incomes by income size classes is nearing completion.

Research Projects at Dun & Bradstreet, Inc.

Tax Payment Survey. The preliminary report, based on the first 10,000 returns, was published in the April issue of *Dun's Review.* Seven kinds of tax payments were computed as percentages of the sales volume for eight groups of manufacturing, nine groups of retailing, and for the wholesaling field in total. A more complete report, based on 25,000 returns is now in preparation for the June or July issue of *Dun's Review.* Tax payments in the case of manufacturers will be computed as percentages of the value added by manufacture, in the case of wholesalers and retailers, as percentages of the gross margin. The number of case histories of tax payments by business enterprises over a period of years will also be included. Walter Mitchell, Jr., is in charge of the Survey and Professors Carl Shoup of Columbia University and Paul Studenski of New York University are acting as consultants. A special study of regional differences in tax payments made by business will be carried on during the summer and is expected to be ready for publication in the early fall.

Business Trend Survey. Final reports on the trend of sales from 1937 to

1938 and the trend of inventories during 1938 are based on about 35,000 returns, and will appear in the May issue of *Dun's Review*. Separate estimates are included for 48 lines of manufacturing, 20 lines of wholesaling, 44 lines of retailing, 13 service, 6 construction and 3 types of mines and quarries.

Mid-Year Inventory Survey. A special questionnaire mailing is planned in order to obtain a picture of inventories as of June 30, 1939, in comparison with holdings of a year earlier and at the beginning of 1939.

Measuring Municipal Debt. The Municipal Service Department is working on a project of evaluating the overall or direct and overlapping debts of cities over 50,000 population. They will be considered comparatively in relation to wealth, type of city, cyclical stability, debt structure, effect of depression on trend, and budgetary requirement for debt service.

The Twentieth Century Fund

Two new studies have been initiated. The first of these is a study of the relations between government and the electric light and power industry. This will involve an appraisal of the regulation of electrical rates by cities, states, and federal power commissions, of public operation by municipalities and federal authorities, and of the control of the financial structures of public utilities and of the market areas with companies integrated through holding companies. It will necessarily involve a considerable statistical treatment based primarily, however, on data already accumulated and available in various official and corporation reports.

In addition, a study of collective bargaining has been initiated. This will involve the appraisal of the status of collective bargaining in ten or twelve of the major industries, with emphasis, of course, upon recent and current developments in the light of data collected. An interpretation and evaluation of policies, procedures, etc., of collective bargaining will be made. This study will not be primarily of a statistical nature, although the preliminary facts will necessitate a good deal of statistical analysis as to membership, activities, etc., of labor unions.

Somewhat more statistical in nature is the study of the effects of short selling on the security markets which was commenced over a year ago and is proceeding rapidly to completion. This involves the statistical analysis of a large amount of material assembled from the records of the New York Stock Exchange and relating to various aspects of trading in securities on that Exchange.

The study of distribution and its costs is now nearing completion and should appear in print within two months. This has been largely statistical in nature, involving the presentation of considerable data on costs of distribution, clarifying by kinds of trade, types of organization, large and small commodities, etc. Statistical estimates of the total volume and the flow of trade and of total costs have also been made.

Work is also proceeding on the study of salaries of the officers of large corporations, which is part of the Corporation Survey commenced several years ago. This work will probably be completed within the next six months.

CHAPTER ACTIVITIES

The Albany Chapter

The Albany Chapter of the American Statistical Association held a dinner meeting February 7. Forty-seven members and guests were present. Fred J. Decker, President of the Chapter, presided.

Two out-of-town guests were introduced: Roman Cresin, of the Central Institute of Statistics in Roumania, and Mr. Jenkins, of the U. S. Department of Agriculture, East Lansing, Michigan.

Roy L. Gillett reported briefly on the Detroit meetings of the American Statistical Association.

The President, Fred J. Decker, announced the appointment of the following committee to work on the coordination of state statistics: W. W. Coxe, chairman, Horatio M. Pollock, David M. Schneider, Mildred M. Lauder, and C. M. Armstrong, Jr. Mr. Decker outlined the program of the committee as follows: First, contact interested persons, not necessarily members of the Chapter, and users of state publications to determine what is wanted; second, formulate a program or set of recommendations to be endorsed by the Chapter; and third, present these recommendations to the Governor and the Director of the Budget.

There followed a panel discussion on the subject, "What Should a Civil Service Examination for a Statistician Contain?" Members of the panel were: Charles L. Campbell, Director of Classification, Department of Civil Service; David M. Schneider, Director of Research and Statistics, Department of Social Welfare; Roy L. Gillett, Director of Agricultural Statistics, Department of Agriculture and Markets; and E. H. Van Winkle, Rensselaer Polytechnic Institute, Troy, New York. The discussion was divided into three parts, (a) general lists vs. specialized lists for the various departments, (b) what sort of questions should be used to test technical knowledge, and (c) how to test for administrative and supervisory ability. The discussion brought out the fact that there are two schools of thought on the subject of specialized lists for the lower grades of professional statisticians. Specialization in a particular field is usually necessary in the higher grades. Written examinations should test ability to apply statistical techniques rather than memorizing of formulae. No easy method was suggested for testing administrative ability.

A dinner meeting was held on March 9, at which F. J. Decker, President of the Chapter, presided. Thirty-five members and guests were present. The entire meeting was turned over to the program committee. E. H. Van Winkle introduced Theodore H. Brown, Professor of Business Statistics at the Graduate School of Business Administration, Harvard University, who spoke on the theory of sampling in business. Dr. Brown emphasized the "horse sense" approach to statistics, urging the careful planning of each experiment or test before the inquiry is begun and deploring the vast amount of data that is gathered by business concerns and government agencies which

is later found to be useless. He pointed out that no scientist worthy of the name would begin an experiment without having clearly in mind just what questions he wanted to have answered.

During the discussion following Dr. Brown's talk, the question was raised as to what should be required of a junior statistician in state service and whether generalized or specialized lists were to be preferred. Dr. Brown expressed the belief that what he called the "social attributes" required in a particular job were extremely important. While he admitted that it was difficult to test for these attributes he considered the expense of setting up special examinations "trivial" compared with the value of securing the right man for the job.

The Austin, Texas, Chapter

Craig D. Campbell and Donald G. Wiginton, of the staff of the Bureau of Business Research of The University of Texas, were the principal speakers at a regular meeting of the Austin Chapter held February 3, 1939. Their joint subject was, "New Employment and Pay-Roll Indexes for Texas," and related to the construction of indexes of employment and pay rolls for each of twenty important manufacturing industries in Texas, and weighted composite indexes for all manufacturing industries combined, and the adjustment of those indexes to the Census of Manufactures.

Data from which the indexes were constructed were collected monthly over a period of ten years by the Bureau of Business Research in cooperation with the United States Bureau of Labor Statistics. Data were supplied from about 600 Texas factories. Based on employee-coverage, the sample ranged from about 15 per cent in some industries to more than 90 per cent in others, averaging slightly less than 50 per cent for manufacturing as a whole.

From January, 1929, to December, 1934, a fixed sample of reporting firms was used. From January, 1935, the sample was gradually increased, and the indexes were computed from that date on a link-relative basis. The composite for total manufacturing was constructed by weighting the indexes for each industry by its aggregate employment and wages, as reported by the Census of Manufactures.

Adjustment to the Census was made at two-year intervals—1931, 1933, and 1935. The adjustment consisted of bringing the average of the monthly indexes for the census year into line with the census figures. This was done by apportioning, progressively, the difference between the change reflected by the index and that reflected by census figures.

The need for statistics pertaining to the labor situation was outlined. A brief description of earlier indexes was given, and the developments which led to the construction of the new indexes. It was pointed out that because the data were compiled on a sample basis, and because only changes in existing establishments were reflected, a periodic adjustment to a more comprehensive survey was essential. While the discrepancy accumulating over a two-year interval was in most cases nominal, a ten-year accumulation of

error would be sufficient to render the indexes useless for certain purposes.

Some of the more common uses of employment statistics by government, labor organizations, and private business were mentioned. The importance of pay rolls was stressed by pointing out that this source represents approximately 68 per cent of total national income.

Publication of the Bureau's newly constructed indexes awaits adjustment to the Census of Manufactures for 1937, and the completion of several related studies, particularly those pertaining to average earnings, average hours, and seasonal variations.

At a luncheon meeting of the Chapter held on March 23, Howard V. Jordan, Associate Soil Technologist, Bureau of Plant Industry of the United States Department of Agriculture, delivered an address entitled, "Statistical Methods as Applied to Field Experiment."

After outlining the early experiments pertaining to soil fertility, and pointing out the obvious inadequacy of the methods used, the speaker discussed the problems which led to the application of statistical technique to such experiments. These problems related principally to the inability to eliminate factors other than soil fertility which influenced the results of the experiments, or to measure the extent to which such extraneous factors influenced the results.

A technique developed by R. A. Fisher is now in use and is generally regarded as the best practicable method of eliminating undesirable factors in the experiment, and measuring the degree of probable error in the final result. The method involves the use of multiple plots formed in a square, the total number of plots being determined by squaring the number of different fertilizers to be employed plus one for plots which are not to be fertilized. The plots are distributed at random within the square, with the exception that one of each kind of plot will be located in each horizontal row of the square, and no two identical plots will be located in the same column. The method of tabulating the results, computing the extent of influence of the various extraneous factors, and determining the probable error in the final results was discussed at length.

The Boston Chapter

A special meeting of the Boston Chapter was held on Tuesday evening, November 29, 1938. The general topic for discussion was "Relationship Between Relief Expenditures and Employment." The speakers were Ralph G. Hurlin, Director, Department of Statistics, Russell Sage Foundation, and John J. Donnelly, Statistician, Massachusetts Department of Public Welfare.

Mr. Hurlin reviewed the growth of relief expenditures over the past three decades and discussed problems of measuring both relief expenditures and employment. Fluctuations in relief and employment over the period, he found, did not on the whole appear to be closely correlated and were obscured by a succession of major changes in public attitude toward and in

standards of relief. It was his opinion that governmental relief in some form will continue without much or long reduction from the present level. By reference to estimates of national income, he showed that the relief expenditures of recent years have represented a relatively small diversion of purchasing power.

Mr. Donnelly discussed more particularly the social relief problem in Massachusetts, and presented a series of charts, showing the trends in relief expenditures in Massachusetts during recent years.

Following the addresses there was a lively discussion, in which representatives from the regional office of the Social Security Board and others engaged in social work participated.

The eleventh annual meeting of the Boston Chapter was held on March 6, 1939. At the business session, the following officers were reelected to serve during the ensuing year: President, Edmund S. Cogswell, Massachusetts Department of Insurance; Vice-President, Theodore H. Brown, Harvard Graduate School of Business Administration; Secretary, Roswell F. Phelps, Massachusetts Department of Labor and Industries; Treasurer, E. L. Quirin, Babson's Statistical Organization; and Counsellors, Charles A. Bliss, Harvard Graduate School of Business Administration, and Howard C. Baldwin, Babson's Reports, Inc.

The subject for discussion at this meeting was "Centralization Versus Decentralization of Statistics." The speaker for the evening was Halbert L. Dunn, Chief of the Division of Vital Statistics, U. S. Bureau of the Census. The following is a brief summary of his address:

Without a doubt, much overlap exists between the statistics collected by various Government agencies. A coordination of the activities of agencies which will reduce this overlap to a minimum is not a simple matter since it is involved not only with statistics, but also with administrative procedure for which the statistics were primarily authorized. Certain principles must be met in order to arrive at a solution of the problem:

1. Accurate knowledge of the degree of overlap in the statistical practices, programs, interests, and intents of the various agencies is necessary. This involves the creation of some sort of a centralized current register.

2. A mandate to a centralized group to bring together interested agencies with whatever powers are necessary to produce a reasonable consideration of the problem.

3. A judicial consideration of problems which cannot be solved by conferences is essential if overlap is to be eliminated. Such judicial functions must be carried out in an appropriate and unbiased manner.

4. Whatever action is taken must protect the public, both from the standpoint of safeguarding the information given in confidence to the Government, as well as to minimize the number of approaches by field workers who make requests for information.

The address by Doctor Dunn proved to be of much interest to the members and guests present, particularly in view of the consideration which is

being given to this subject at this time, and the recent publication of the "Report of the Central Statistical Board" on the returns made by the public to the Federal Government. The address was followed by general discussion, in which many of those present participated.—*Roswell F. Phelps.*

The Chicago Chapter

"Marketing Trends That Will Affect Tomorrow's Sales" was the subject of the meeting of the Chicago Chapter on February 7. Phillip Salisbury, General Manager and Executive Editor of *Sales Management Magazine*, spoke briefly about many phases of business that he had observed in his contacts with businessmen and business conditions which appeared to be significant indicators of marketing changes and trends. Following his talk, Mr. Salisbury answered a number of questions raised by members, discussing more fully some of the points mentioned briefly in his résumé, and also called on some of the members to supplement his remarks from their own experience.

Dr. Willard L. Thorp, Director of Research, Dun & Bradstreet, was the speaker of the meeting on March 14. Dr. Thorp gave a comprehensive discussion of the work of the Temporary National Economic Committee, covering the organization of the committee, the method of procedure, and some of the studies that had been made to date.

The Cincinnati Chapter

Officers for the following year were elected on March 9 as follows: President, Paul Horst, Personnel Research Department, The Procter & Gamble Co.; Vice-President, Edgar Z. Palmer, Assistant Director of the Bureau of Business Research, University of Kentucky; and Secretary, Douglas E. Scates, Director, Bureau of School Research, Cincinnati Public Schools. Professor W. A. Baude, University of Cincinnati, the retiring president, addressed the meeting on applications of Fisher's sampling error formulas.

The Cleveland Chapter

At the fourth meeting of the present season on January 30, John Love, columnist for the *Cleveland Press*, and President of the local chapter, addressed the group on "The Recovery Industries of 1939." His discussion covered the near term expansion in such industries as aviation, plastics and synthetic fibers.

F. T. Carlton, of Case School of Applied Science, also a member of the local chapter, spoke at the fifth meeting on March 6. Dr. Carlton's subject was "Technology and Economics." The speaker talked of the changing factors affecting the economic structure, including the slowing down in population growth. Dr. Carlton believes that a better job of economic planning must be done with the federal government playing a more important role.

The sixth meeting was held on March 30. Russell Weisman, of the *Cleveland Plain Dealer*, presented his views on the current economic outlook.

The speaker discussed the failure of the recovery to progress further due primarily to a lack of new capital investment. Mr. Weisman placed the blame on the policies of the dictators and the "New Deal" stressing the failure of the national government to make any progress in balancing the budget.

A committee of the local chapter is cooperating with the Works Progress Administration in compiling a statistical year book for Cleveland.

The Detroit District Chapter

A meeting of the Detroit District Chapter was held on February 23 at which Paul L. Stanchfield, Chief of the Research and Statistics Section of the Michigan Unemployment Compensation Commission, spoke on "The Contribution of the Unemployment Compensation and Employment Service Program to the Field of Statistics."

On March 17, the Chapter held a joint session with the Economics Section of the Michigan Academy of Political and Social Science. The meeting was addressed by P. Sargent Florance, of Birmingham University, England, whose subject was "Efficiency in Relation to Size of Organization."

The Harrisburg Statistical Society

A dinner meeting of the Harrisburg Statistical Society was held on March 8 and was followed by a program on the topic of "Statistical Applications of Accounting Data." Mr. Harry M. Kurth, Accountant-in-Charge of the Pennsylvania State Accounts Office of the United States Treasury, as speaker, outlined the results of production and procedures over the past several years and presented the statistical uses of financial operations data in Pennsylvania by means of charts and tables, showing the current records and prompt reporting carried on under his supervision. Over forty persons attended this meeting.

On March 20 a meeting was called at 8:00 P.M., at which a program on the subject of wage and hours administration was discussed. Mr. Frank Stocking, an economist of the Wage and Hour Division, U. S. Department of Labor, addressed a group of fifty local statisticians and led a rather extended discussion on difficulties in administration, with special emphasis upon minimum wage rate determination.

The New York District Chapter

"Factors in a Health Control Program" was the general topic of a meeting of the Chapter on January 18. Dr. Hugo Muench of The Rockefeller Foundation was the presiding officer.

Mr. Thomas J. Duffield, Registrar of Records of the New York City Health Department, described the collaboration of the Bureau of Records with the committees on maternal welfare in the county medical societies in three counties of New York City. This collaboration started in the sum-

mer of 1936, when the Kings County Medical Society requested certain data on deaths from puerperal causes. The information was readily provided from statistical punch cards. Copies of the death certificates are furnished weekly to the committees on maternal welfare. Mr. Duffield stated that the period of experience was too short to indicate whether or not this work of the medical societies had had any effect upon the maternal mortality rate in New York City. He pointed out that the rate in 1937 and in 1938 was considerably lower than it had been in any of the preceding thirty years, but added that 1938 was an unusually healthy year.

After a short period of experience, collaboration with the Kings County Medical Society revealed the fact that the information which was being collected on births and fetal deaths was definitely inadequate, and arrangements were made to collect much more information concerning births and stillbirths than has ever been collected by any public health agency in the country. Mr. Duffield called attention to the fact that shortly after the Health Department started to collect this information, the committees on maternal welfare in the medical societies developed some interest in collecting information regarding neonatal and fetal mortality, and in two counties, at least, they now have active committees working to combat mortality in these two groups. Mr. Duffield concluded by showing a few slides to illustrate the types of tabulations made and the new information called for on the revised birth and stillbirth records.

Mr. Duffield's paper was discussed from the medical point of view by Dr. Charles Gordon, Chairman of the Maternal Welfare Committee of the Kings County Medical Society. He related in detail how the data supplied by the Health Department are used. The first step was to set up a committee to analyze all maternal deaths. This committee contains a representative from each hospital. The hospital is allowed to select its own representative. The certificates are sent to the committee representative of the hospital in which the death occurred. For some deaths, of which there are a small number in Brooklyn, a woman doctor handles the detail. Along with the death certificate a long and detailed four-page folder, called a study folder, is sent. These folders, containing a great many questions, are filled out very well, and when a résumé of the case has been entered on the folder it is returned to the office of the Medical Society of Kings County. The committee meets once or twice a month. Admission to the conferences is restricted to doctors, but any doctor may attend. The usual attendance is from 180 to 200.

Each case is read by the chairman in its entirety, except that the doctor, the patient, and the hospital are not identified. There is then a thorough discussion of the questions, "Is the case properly a puerperal death or should it be changed to another cause?" and "Was it a preventable death?" In the course of the discussion, for example, someone may say that the death could have been prevented if a transfusion had been given or if the mother had received adequate pre-natal care. The background of the case is then discussed, chiefly as to what kind of care was received.

Sometimes during the meeting a doctor will stand up and say that he had the case which is under discussion. He relates what he did and asks why he should have done otherwise. From all this discussion a great deal of information, which is highly educational, develops. Dr. Gordon feels the most important phase of this whole set-up is the education of the doctors. He pointed out that in medical schools the obstetrical cases coming under the doctors' care are normal cases with no complications involved. When the doctor is later connected with a hospital he comes across cases which he is really not capable of handling. At these meetings, then, every case is discussed thoroughly and freely and the doctors learn a great deal. Dr. Gordon expressed appreciation of the collaboration of the Department of Health and stated that the Medical Society is endeavoring to get better reporting on both birth and death certificates.

Miss Lida J. Usilton, of the United States Public Health Service, discussed the second topic, "Do 10 in 100 have syphilis?," reviewing recent articles on the subject, and presented charts and tables showing the basis for the estimates that one person in 100 of the general population has syphilis and ten in 100 will come under treatment at some time during their lifetimes. These estimates are based on the attack rates during 1936 and 1937 reported by 8700 physicians and 300 clinics and institutions for some 6,000,000 persons which they served. She pointed out that these attack rates are subject to revision when additional data become available.

Dr. Walter Clarke, Executive Director of the American Social Hygiene Association, discussed Miss Usilton's paper. He pointed out that the data used in estimating the attack rate included only those cases which actually came under medical supervision in the early states of the disease. From his experience and that of others he believed that a large number of cases are missed, including those that never seek medical supervision and many cases of congenital syphilis. He also called attention to the recent sharp increase in the number of cases brought under treatment in New York City. The method of estimating he believed to be ingenious, but difficult for the public to understand, and he recommended a simple statement that the estimated prevalence is 5 per cent, basing this figure on nearly 3,000,000 serological tests.

Mr. Frank Van Dyk, Executive Director of the Associated Hospital Service of New York answered the question, "How do we know that three cents a day will cover hospital costs?" He reviewed more than three years of experience under the plan operated by the Associated Hospital Service. Only 83 per cent of the earned income is required to pay hospital bills. Thirteen per cent is used to meet expenses of operating service, and 4 per cent is held as a reserve. Mr. Van Dyk also presented detailed information about the length of stay and various characteristics of the membership.

A paper on "How could morbidity reporting be accomplished?," by Dr. Helen Jeter and Dr. Marta Frankel, was read by Dr. Haven Emerson. It was suggested that a good start could be made if hospitals would report

regularly and completely all cases coming to their attention. Problems of selecting or developing a standard nomenclature were discussed.

Approximately 110 persons attended this meeting of the Public Health Committee of the New York District Chapter. The program committee consisted of Jessamine S. Whitney, Chairman; Mary Augusta Clark, Thomas J. Duffield, Charles B. Lawrence, Jr., Dr. Hugo Muench, and Dr. W. Frank Walker. (*Condensed from a report by Jessamine S. Whitney.*)

To an unusually distinguished audience consisting of members and guests of the American Statistical Association, Chairman Joseph P. McElroy on Tuesday evening, April 18, at the Hotel Woodstock, New York, introduced four outstanding students of business conditions. The general topic of the evening was "The Government's new emphasis on recovery and its relation to the stock market."

The first speaker was Donald Ellsworth, since 1933 editor of *The Annalist.* His subject was "Some conditions under which the 'appeasement' program might bring recovery." Mr. Ellsworth prefaced his remarks by stating that he did not wish the title selected to indicate that he expected or did not expect business recovery from this stage, that he was uncertain about the business outlook at the present time. Nevertheless, "appeasement" efforts are important as aids to recovery. He defined "appeasement" as any plan which might bring about more cordial relations between the Government and business. Government, he thought, today has a real desire to help business, to increase business activity. While Government has found it difficult to transform this desire into positive action, it has at least caused a reduction in the number of new laws passed unfavorable to business. He hopes that the Government will reduce its spending activities before they lead the country into a disastrous situation. He granted that spending has been of some benefit to farmers and to home owners, but pointed out that it has resulted in no aid to municipalities which still find themselves in general in a critical financial condition and spending budgets still rising. About 35 per cent of the national income is absorbed in cost of government, an uncomfortably high level. Mr. Ellsworth estimates that the Federal Budget for 1940 will show an increase over the current fiscal year budget without including many supplemental appropriations likely to be added. In spite of the fact that work relief today is too expensive and relatively inefficient, it is likely to continue. Yet, it would help if work relief activities were put on a better basis. It would be particularly helpful if joint expenditures by the Federal Government and state and local governments were discontinued because of the demoralizing influences of such cooperation on the local governments. Another form of "appeasement" most desirable would be tax revision to a more realistic basis. Some tax laws are depressing business without producing appreciable revenues for the Government.

The second speaker was Mr. R. Dana Skinner, Vice-President of the Townsend Skinner Company. He spoke on "Deficit Money Supply and the Stock Market." He presented a study to determine the influence which the

Federal Government's borrowing would have had on money supply and on interest rates if simultaneously there had not been a major increase in gold supply. It was assumed that the Federal Reserve System through open market operations would have purchased Government obligations in about the amount of the annual deficits and that other factors remained equal. He concluded that high grade bond prices today would be at about 4 per cent. Interest rates would be higher to the extent that commercial loans might be higher than today's level. Therefore, had it not been for the gold inflow, most of the benefit of increased activity in bank debits due to Government deficit spending would by now have disappeared.

Thomas S. Holden, Vice-President of F. W. Dodge Corporation, spoke on "Construction Business Facts and Folklore." Mr. Holden observed that the New Deal was in the "dog-house." For this reason he thought that it was particularly necessary to discriminate carefully between New Deal innovations. Not all of them should be discarded. He thought that in certain instances progress had been made toward adjusting to economic conditions as they exist today and eliminating "folklore" economics. He defined folklore economics as ritualistic practices carried on long after people had forgotten the original reasons for creating the ritual. We have, he thought, been carrying on with a debtor economy system after we have become a creditor nation. Naturally, therefore, we have had difficulties. The 1936–1937 building expansion period was considered by many to be an old-fashioned building boom and disillusionment followed when it failed to carry through. What the nation is in is a transition period.

In real estate finance, folklore methods have persisted in spite of the fact that two revolutions in real estate have taken place. In the 1920's the rate of immigration was so reduced by law that it lowered the rate of expansion of population in the United States, and, therefore, the size of the new market for homes and other forms of building. In addition, the tremendously expanded use of the automobile and the hard surface highway radically expanded the supply of economically useful land. The era of speculative real estate is over. Today real estate may best be considered to have value not in the general American concept of value as represented by the estimated selling price, but in the English sense as representing so many dollars per year income.

These revolutionary changes have necessitated changes in mortgage lending procedure. Formerly, if the owner of a piece of real estate failed to meet his mortgage obligations, the owner of the mortgage foreclosed, and frequently was pleased to do so because he felt that he might thereby secure an added profit on his investment. Nowadays, mortgages are being written for a larger percentage of the total cost of a property. A first mortgage in amount of 80 per cent to 90 per cent of the cost of a property is frequently written. This practice is considered to be sound if two additional safeguards are included. The principal of the mortgage should be amortized at monthly or annual intervals in order that the mortgage may more assuredly remain

healthy in relation to the depreciated value of the property. The second new feature of mortgage lending emphasized today is the factor of the personal credit rating of the borrower. The borrower must now make himself personally liable for his mortgage obligation as well as pledge his property. It is important that he be a responsible citizen.

In order to implement this new system real estate promotion, a supply of funds available had to be substantially increased. The National Housing Act was passed; it created the Federal Housing Administration. The Federal Housing Administration proceeded greatly to increase the number of institutions in the field of mortgage lending beyond the few who always were in it. Today there is a large supply of mortgage money available and there is a wide and growing acceptance of the soundness of the Federal Housing Administration methods.

The radical increase in the supply of land suited to residential development and relocation of industries has also created a need for a substantial amount of additional public works. Therefore, a reasonable continuance of the Public Works Administration activities is desirable in order that these economically sound public improvements may be undertaken. Unfortunately the redistribution of population and other factors have not improved existing local credits. New money supplies can most effectively come from the Federal Government.

The amount of public improvements and private construction desirable should not necessarily be related to any past estimate of average building construction. There is no normal amount of building. The amount of work to be done should be related to the need.

Mr. Holden believes that the outlook for building in 1939 remains very good. War scares do not seem as yet to have hurt building activities and it is hard to say whether they will. He gave figures to show that activity is substantially higher than a year ago.

The final speaker on the program was Dr. Charles Roos, Director of Research, The Institute of Applied Econometrics, Inc. He presented a study on "The Influence of Government on New Orders for Consumers' Goods, Durable Consumers' Goods and Capital Goods." Dr. Roos presented a chart showing that the amount of new money financing by political units in the United States in the 1920's was relatively stable throughout the period and showed no correlation with business activity. In the 1930 decade he concluded that there was no clear correlation either, although in the 1934–1936 period there was some broad parallelism. Therefore, he concluded, there is no correlation between Government spending and business activity.

At the conclusion of the evening Mr. McElroy made the startling announcement that our District Representative, Helen Slade, felt that she was unable to continue in her office and had resigned. This is a development of great concern to the New York Chapter. It has been largely her great energy and initiative which has produced the remarkable series of successful chapter dinners. It has been at her home that many members of the Association have

so frequently foregathered to carry on an evening of discussion just a few points further. There are few leading analysts and statisticians indeed who are not indebted to the hospitality so generously extended by her husband and herself. Even though success seems dubious, one cannot but hope that so many of her friends will beg her to reconsider her resignation that she will find some way of remaining the New York Chapter's animating force. —*Reported by Warren Clark.*

The Philadelphia Chapter

Two meetings of the Philadelphia Chapter have been held since December. In February, the topic was "The Pros and Cons of Railroad Consolidation." The following two speakers addressed the Chapter: John R. Turney, member of the Washington bar, formerly Vice-President of Traffic and Law of the St. Louis-Southwestern Railway, and formerly Director, Section of Transportation Service, Federal Coordinator of Transportation, on the subject, "The Freight and Passenger Service Aspects of Railroad Consolidation," and Shelby C. Davis, Economist of the Delaware Fund, Inc., who discussed "The Financial Aspects of Railroad Consolidation."[1]

In March, the problem of Social Security was discussed by Ewan Clague, Director of the Bureau of Research and Statistics of the Social Security Board, who spoke on "Proposed Changes in the Social Security Act," and M. A. Linton, President of the Provident Mutual Life Insurance Company, whose topic was "Making Old-Age Security Work." Both meetings were well attended and both were followed by animated discussion.

The San Francisco Chapter

"A Statistical Basis for Setting Wage Rates" was described by Donald Patterson, Cost Engineer of The Paraffine Companies at Emeryville, at a meeting of the Chapter on February 2.[2]

At a meeting on April 4, Mr. M. I. Gershenson of the Division of Labor Statistics and Law Enforcement in the State Department of Industrial Relations discussed "Labor Statistics in California—What We Have and What We Do Not Have." A committee of the Chapter appointed to examine the current labor statistics pertaining to California participated in the discussion.

The Washington Statistical Society

A meeting of the Washington Chapter was held on February 28 to discuss "The Accounting System of the Federal Government." The President of the Chapter, Dr. Halbert L. Dunn, of the Bureau of the Census, presided. The principal speakers were Henry P. Seideman, Treasurer of the Brookings Institution, Mordecai Ezekiel, Economic Adviser to the Secretary of Agri-

[1] See p. 269.

[2] A summary of Mr. Patterson's discussion is presented on page 365.

culture, and William L. Slattery, Comptroller and Budget Officer, Post Office Department.

"The Appraisal of Radio Effectiveness" was discussed at a meeting on March 23 by Frank Stanton, Manager of the Research Division of the Columbia Broadcasting System and Assistant Director of the Office of Radio Research of Princeton University; Alfred D. Stedman, Washington Correspondent of the *St. Paul Dispatch* and *St. Paul Pioneer Press*, presided.

A meeting of the Chapter was held on April 20 with Leon Henderson, Executive Secretary of the Temporary National Economic Committee, presiding. Bassett Jones of Meyer, Strong and Jones, Construction Engineers, discussed "Numbers Called Money" and Arne Fisher, Statistician of the Western Union Telegraph Company, produced "Irrelevant Remarks on Trivial Matters in Modern Statistical Theory."

NEW MEMBERS

Bassie, V. Lewis, Senior Economist, Federal Reserve Board, Washington, D. C.

Becker, Otto, Clerk in Statistical Department, Beneficial Management Corporation, Newark, New Jersey

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JOSEPH A. HILL

The recent death on December 12, 1938, of Dr. Joseph A. Hill is an irreparable loss to statisticians, sociologists, economists, and political scientists. It is also a great loss to the public service of the country. It is difficult not to add that from the point of view of his associates, friends, and disciples it leaves a void that cannot be filled. This sketch, however, will concern itself exclusively with Dr. Hill as a member of the statistical profession; the sense of personal loss felt by the writer and many others will not be permitted to intrude itself into the narrative.

Dr. Hill died at the age of 78 and he had been engaged in statistical work for half a century. The nature of his work was such as to afford little opportunity for publicity, which he never sought, and it is probable that relatively few men even in the profession, and particularly few of the younger men, are familiar with the magnitude and quality of the contribution that he has made to statistics.

There are three separate stages in the statistical process, as in the production of goods: production of the raw material, processing or conversion of this material into usable form, and consumption. Dr. Hill was concerned primarily, though by no means exclusively, with the arduous and relatively thankless job of production and processing of statistics, for the most part leaving to others the more fascinating opportunity of using them as tools in reaching conclusions and presenting them to the public. Relative anonymity was inherent in the nature of his work.

It was Dr. Hill's principal function to so shape the collection and preparation of statistics as to serve the maximum number of users in the most acceptable way, and at the same time to remain within the limits of resources available for clerical work and for printing.

The nature of some inquiries, such for example as the number of persons in the United States, is determined by law and in this particular case by the constitution itself. But what to find out about each individual member of the population has been a problem that recurs every ten years and on which much time and thought has been spent since 1900, largely under Dr. Hill's leadership. In most statistical undertakings, however, the first and crucial question is the determination of the problems that are susceptible of quantitative measurement and the answer to which would repay for the cost of the investigation. The question of timing the inquiry so that the answer will at the same time not be distorted by transitory conditions and will not be too

long delayed is also a cardinal one in statistics, and one on which Dr. Hill's judgment was always shrewd and sound.

Much of the work on which Dr. Hill was engaged was of the census variety—representing complete enumerations of the units in the field to be surveyed. But he was not unaware of the value and the technique of sampling, both as a preliminary to enumeration and as a check on the results, as well as a substitute for enumerations that would be too lengthy and too costly. A critical and honest appraisal of the degree and character of coverage required for a fair answer to a problem is one of the rarest and most valuable achievements of a statistician. Dr. Hill's judgment in such matters was unerring.

Editing and verification of raw material of statistics collected in the field is the next step in the statistical process, and in this field Dr. Hill was instrumental in developing a delicate balance between necessary care and extravagant meticulousness. This sort of service produces no renown, but on it rests in the final analysis the truthfulness of reports on which the users have the right to rely. In Dr. Hill's publications there was always an honest and precise statement of the margin of error involved in the material. With such a statement the honest user of statistics would never be led astray.

Dr. Hill also had a guiding hand in the planning of statistical tables into which the results of inquiries were incorporated. He had a fine sense of the distinction between the general table, which should clearly present as much material to meet the needs of as many users as possible, and the special purpose or text table, which is designed to bring out a specific point. This may seem obscure and unimportant, but on the way these matters are handled may depend the actual value of the results of an investigation which may have cost millions of dollars. It corresponds to the role of the chef in planning a banquet. The guests may pay little attention to the order and quantity of the courses, but the good or ill effects of the banquet depend on skillful planning of these details. A well-constructed statistical volume with clear and precise headings and titles and with text tables pointing up the conclusions brought out by the inquiry is not a common sight even today, but the technique of the preparation of such a volume has been greatly perfected as the result of Dr. Hill's patient, imaginative, but unspectacular work over the years.

But, after all, the greatest of Dr. Hill's services was in the presentation of the results of an inquiry in clear and accurate language—cutting through technical details to the heart of the problem—and showing precisely to what questions the data do and do not afford answers. The art of extracting the last drop of legitimate meaning out of a body of statistics is a high and a rare art. But a higher and rarer art is an unflinching recognition of what the figures do not and cannot prove and the self-discipline that results in refraining from stretching the material to prove some pet theory of the statistician. In this art Dr. Hill excelled and those of us who are his disciples can

never be grateful enough for the rigid course of moral and intellectual training that we received in this vital matter under his tutelage.

This in brief is the abstract story of Dr. Hill's service to statistics. No full account of what he has done can possibly be prepared because his influence was important in all the phases of the work of the Census Bureau with which he was identified for a generation and reached far beyond the confines of this Bureau. With the great increase in the need for information as a basis for public policy—the quality and reliability of available statistical material has become increasingly a matter of public concern. Dr. Hill's work, largely behind the scenes, in improving the quality of the material on which public policy is based, and increasing the clarity of the interpretations of this material constitutes a distinguished public service of the first magnitude.

In this work relatively little of the higher mathematical and statistical technique was required. There are phases of public work in which this technique is essential—and this is generally given adequate and perhaps in some cases exaggerated recognition. But there is not the same measure of appreciation of the far more important phase of statistical work in the social science field, namely, the ability of choosing worth while and measurable subjects, the collection of representative material, the testing of the integrity and adequacy of this material, the presentation and interpretation of the results with clarity, courage, and vision. It is what Dr. Hill has done in this field and what he has taught others to do, establishing a tradition of valid statistical work, that makes him the outstanding statistician of his generation and a great public servant.

But Dr. Hill was not only an originator and manufacturer of high quality statistics. At times, when opportunity arose, he became a consumer of his own and other people's products in works that raised, discussed, and advanced toward solution many problems of social and political importance. From the time, back in 1899, when he wrote a monograph on the English income tax, which has become a classic on the subject, to the day of his death forty years later Dr. Hill wrote innumerable studies on a variety of subjects, dealing with such problems as marriage and divorce, fecundity of immigrant women, insanity in the United States, and child labor. A list of his principal monographs and articles is given at the end of this note. They constitute a library on many of the fundamental social problems of the day.

In his work Dr. Hill was always absorbed in the results and was little concerned in controversy or in personal credit for his labors. He encouraged and inspired one group after another of young men who had the privilege of working with him to achieve the best that was in them. His interest in their achievements was far greater than in his own. Many of his associates and disciples have risen to lofty heights in the service of the country—public and private—and they all retain a respect amounting to reverence and a devotion for Dr. Hill under whose guidance many of them took their first steps in intellectual achievement.

On Dr. Hill's grave there should be inscribed the words: Joseph Adna Hill—thinker, teacher, and public servant—he dared to think with courage and to give freely of his wisdom to his fellowmen.

E. A. GOLDENWEISER

Bibliography of Joseph A. Hill

REPORTS AND MONOGRAPHS

The English Income Tax. 1899.
Statistics of Women at Work. 1907. Census Bureau.
Insane and Feeble-minded in Institutions. 1910. Census Bureau.
Prisoners and Juvenile Delinquents. 1910. Census Bureau.
The Blind in the United States. 1910. Census Bureau.
Deaf-mutes in the United States. 1910. Census Bureau.
The Recent Federal Census of Prisoners. Jan. 17, 1912. Unpublished.
Women in Gainful Occupations. 1929. Census Bureau.

ARTICLES AND PAPERS

"The Historical Value of Census Records." *Annual Report of the American Historical Association,* Vol. I, pp. 197–208, 1908.
"Statistics of Divorce." *American Statistical Association Quarterly:* June, 1909.
"Women Who Work for a Living." *Youth's Companion:* Oct. 28, 1909.
"The Next Census." *Youth's Companion:* March 17, 1910.
"Fecundity of Immigrant Women." The Immigration Commission: 1911.
"Distribution of Immigrants 1850–1900." The Immigration Commission: 1911.
"Occupations of the First and Second Generations of Immigrants in the United States." The Immigration Commission: 1911.
"A Decade of National Growth." *New York Times:* January 17, 1912.
"Marriage Statistics in the United States," paper read before the International Congress of Hygiene and Demography, Washington: Section IV, Demography, 1912.
"The Income Tax of 1913." *Quarterly Journal of Economics:* November, 1913.
"The Extension of the Registration Service." Paper read before the American Statistical Association at Princeton, N. J., December, 1914. Unpublished.
"The Religious Census." Paper given before Federal Council of Churches Conference at Atlantic City: June 4, 1915. Unpublished.
"The Progress of the South as Shown by Census Records," December 10, 1915. Unpublished.
"A Governmental Survey of Business." Address delivered at Meeting of Executive Committee of National Boot and Shoe Mfr.'s Association at Cincinnati, April 26, 1918. Reprint.

"Recent Progress and Plans of the Bureau of the Census." December 28, 1918. Unpublished.

"The Value of Statistics:" October 2, 1919. Unpublished.

"The Essentials of a Good Census." Presidential address, American Statistical Association, Chicago, December, 1919; *American Statistical Association Quarterly*, No. 129, March, 1920.

"Progress of the Population Census:" November 6, 1920. Unpublished.

"Scope of the Fourteenth Census." Unpublished.

"The Census—Facts and Fancies:" March 12, 1921. Unpublished.

"Cooperation between State and Municipal Bureaus and the Federal Census Bureau in the Compilation of Criminal Statistics," paper read at the Thirteenth Annual Meeting of the American Institute, Cincinnati, Ohio, November 18, 1921. *Journal of Criminal Law and Criminology*, Vol. XII, No. 4, February, 1922.

"Some Results of the 1920 Population Census." *American Statistical Association Quarterly:* September, 1922.

"The Organization of a Central Statistical Commission," paper read before the Washington meeting of the American Statistical Association, April 18, 1923. Unpublished.

"Recent Northward Migration of the Negro," paper read before the Eighteenth Annual Meeting of the American Sociological Society, Washington, D. C., December 27, 1923. *Monthly Labor Review*, March, 1924.

"Brick and Statistics," paper read at the Thirty-eighth Annual Convention of the National Brick Manufacturers' Association, Cincinnati, Ohio, January 29 to 31, 1924. Reprint.

"What the Bureau of the Census Does." *National Republic:* January, 1929.

"Apportionment Methods Described." *Congressional Digest:* February, 1929.

"The Census of Distribution in the United States," paper read at the Twenty-first Session of the International Statistical Institute, Mexico City, 1933. *Reports of the International Statistical Institute*, 1938, Vol. 27, Part 1.

"Composition of the American Population by Race and Country of Origin." *Annals of the American Academy of Political and Social Science:* November, 1936.

WARREN MILTON PERSONS

Let us begin at the beginning. Warren Persons was born with indomitable courage, insatiable curiosity, a pioneer's love of adventure, and a mental endowment which enabled him to respond to these inherited impulses by making bold excursions into the higher realms of mathematics. That inheritance may help to illumine what otherwise might seem to be, in part, a dull recital of academic distinctions.

Warren Persons was graduated from the University of Wisconsin in 1899 with the degree of B.S., and in 1916 with the degree of Ph.D. From 1901 to

1906, he taught Mathematics at that university. In 1906, he married Irmagarde Keller of Janesville, Wisconsin, and the same year became Assistant Professor of Economics at Dartmouth College. There he remained until 1910.

But New England winters, combined with his prodigious capacity for hard work, proved too much for him. Before he took caution, tuberculosis was so far advanced that the doctors gave him up for lost: they saw no hope even in the healing powers of a gentler climate.

The fighting powers of the patient and his wife, however, the doctors could not discover with microscopes nor measure with thermometers. In the struggle which followed, Warren Persons and his wife did not falter. Within three years he was Professor of Economics at Colorado College and a member of the Colorado Legislature. The danger of relapse he never left behind, but throughout his life his spirit remained unconquerable.

From 1913 to 1918, while at Colorado College, he attained such distinction in his application of mathematical processes to the problems of economics that he was called to Harvard University, to become Professor of Economics and Editor of the newly-established *Review of Economic Statistics.* There he remained until 1928 when, with customary courage and initiative, he went to New York City to seek adventure as a consulting economist.

As such, he was dependent for his office and living expenses mainly on the commissions which might come to him from large corporations. In this work, because of his eminence in the field, he might have obtained large fees, had he been willing to give in advance the slightest indication that the results of his research would be pleasing to the corporations. So determined was he, however, to retain his integrity as a scientist in pursuit of the truth, that he usually frightened prospective clients away.

A letter which he wrote to a very large corporation, in answer to an inquiry, expresses the attitude which he maintained toward all clients and toward his work, even after a rapid succession of financial losses left him in need of clients. "My chief asset," he wrote, "is to be known as a fearless scientific investigator who will accept only one kind of commission. It is a commission in which I alone am responsible for and prescribe both the methods of research and the conclusions which I draw therefrom. Clients merely have the right to define the field in which they want me to work. . . . Moreover, I must maintain my freedom of speech and of writing on scientific subjects. . . . I am enclosing the ideal of my organization which I have called to the attention of every member of my staff."

The ideal of this organization to which he refers is this:

"Real research requires

Intelligence — Integrity — Curiosity — Imagination — Industry — Patience—Skepticism—Tolerance without Capitulation . . .

Courage to defend the Truth as you see it—

Determination to avoid a favored hypothesis—
to find and abide by the logic of facts
The reward is
Satisfaction from work well done . . . Self-respect from keeping the faith—
The thrill of Discovery!"

Warren Persons' conception of statistics was set forth fully in the graduate course in Statistical Theory and Analysis which he gave at Harvard University. In that course, as elsewhere, he held staunchly to the view that statistics is much more than a collection of numerical facts; that it is, on the contrary, a method and a logic; that it is an applied science in which, therefore, it is just as necessary to scrutinize the premises as the logic and mathematics. Consistent with that view, he took the position that mechanistic and universalistic notions of statistics are mistaken; that the methods to be employed must be chosen with reference to the specific data to which they are to be applied. He held, in short, that economic statistics has the relation to economics and mathematics that mathematical physics has to physics and mathematics.

He held to this point of view in his original work in the construction of innumerable series of index numbers. In every case, he was concerned not only with principles of economics and of mathematics, but also with the peculiar nature of the data with which he was dealing. All this he explained in *The Construction of Index Numbers*, a book published by Houghton Mifflin Company in 1928. Among his other published works are: *Indices of General Business Conditions*, published by the Harvard University Committee on Economic Research, 1919; numerous articles in the *Review of Economic Statistics* and *Supplements*, 1919–1928; *Handbook of Mathematical Statistics*, joint editor, 1924; *The Problem of Business Forecasting*, joint editor, 1926; *Forecasting Business Conditions*, 1931; *Consequences of Price Fixing in Competitive Industries*, 1933; *Government Experimentation in Business*, 1934; and *Municipal and Private Electric Plants in the United States*, 1935.

In the dismal depression year, 1931, when the Government at Washington was drifting helplessly, it was inevitable that Warren Persons should sail forth in an attempt to get somewhere. Feeling the urge of his pioneer inheritance, he could not rest at anchor in the snug harbor of academic inertia. He had always insisted that the final test of economic and statistical theories is the way in which they function when their guidance is most needed. So, in an attempt to reach agreement by economists and statisticians on a constructive program, he wrote an article on the subject. It was published in *Barron's Weekly*, reprinted in the *Literary Digest*, and widely quoted. He then gained for his project the interest of the Twentieth Century Fund and the Social Science Research Council. At a meeting which followed, a group of economists asked the Council to appoint a committee to consider

what to do. A committee was, in fact, appointed, but nothing seemed to come of it.

At this stage, almost anyone else would have allowed the matter to drift along. But not Warren Persons. Entirely on his own initiative, he got together a group of economists and statisticians for a fresh attack. The first outcome was a tentative program. He then spent the days of the annual meeting of the American Economic Association and the American Statistical Association, in Washington, discussing this program with numerous men and continuing to urge action. Out of this discussion and an extensive correspondence came what he called the "Final Economic Program to Initiate Business Recovery." Again on his own initiative and at his own expense, he carried this project forward vigorously until he had complete agreement to his program of more than fifty of our most distinguished economists and statisticians. Anyone who has ever tried to get such a group to agree on anything knows that this was an achievement.

The "Economic Program to Initiate Business Recovery" was based on these premises: the contraction of credit and deflation of prices have gone far enough; the United States can have substantial business recovery without waiting for Europe to solve its problems; recovery is possible on a sound money basis; the depression will not cure itself; and there is, therefore, immediate need of intelligent and vigorous action. The specific action called for in the Program was: passage of a bill enabling the Reconstruction Finance Corporation to deal effectively with the emergency; economy in municipal, state and national budgets and increased taxation; a Federal Reserve policy designed to check credit contraction and encourage expansion; and co-operation of commercial banks with the Reserve banks in checking credit decreases and encouraging increases.

In offering this program to Congress and to private business and finance, Warren Persons declared that "a vigorous prosecution of these policies is sound, involves no important risks, and is likely to be effective in stopping the downward trend of prices, bringing hoarded money back to the banks, restoring values of securities, and supporting business recovery.

In the light of what followed those dismal days of 1931, anyone may form his own judgment of the worth of the Program; but there are many who believe that no group of business men or bankers or politicians offered, at that time, any plan of action which was as effectively designed to speed up recovery.

This account of an attempt to bring about action, in one of the most serious emergencies which our experiment in democracy has yet encountered, is here summarized because it is an example of the way in which Warren Persons adhered, in practice, to the principles of statistics which he taught to his students in Harvard University.

From 1908, when he joined the American Statistical Association, until his death on October 11, 1937, Warren Persons was a helpful member of the Association. He was elected a Fellow of the Association in 1914, Associate

Editor of the Journal in the same year, and President of the Association in 1923. At various times he served on the following committees: Nominations, Fellows, Price Statistics, Business Statistics, Library, Place of Meeting, and Classification of New Members.

And now, returning to the distinguishing traits of his inheritance and attempting to sum up his attitude to life, we can do no better than to give his own choice of "Values," written not long before his death.

To have intelligence, integrity, imagination, initiative, fortitude, tolerance, delicacy,
And modesty—a candle to these merits;
To be balanced and alive in body, mind, spirit;
To chuckle at the world—and one's self;
To have music in one's soul;
To labor: and experience the contentment from work well done;
To create: and know the thrill of discovery;
To earn a little and spend less;
To be courteous, to be kind, to keep faith;
And so to gain courtesy, kindness, faith, fellowship;
This is the joy of living.

WILLIAM TRUFANT FOSTER

BOOK REVIEWS

GLENN E. MCLAUGHLIN
Review Editor

Introduction to Economic Statistics, by William Leonard Crum, Alson Currie Patton, and Arthur Rothwell Tebbutt. New York and London: McGraw-Hill Book Company, Inc. 1938. xi, 423 pages. $4.00.

A book of similar title was published in 1925, but this volume is a complete revision. Certain portions, especially the first three chapters are almost entirely new, the illustrative materials have been brought up to date, enlarged, and extended, and some of the more advanced materials of the earlier text have been either eliminated or given less emphasis. "The book has been prepared while keeping constantly in mind the needs of those students who are interested in the application of statistical methods to economic problems;" it is "an elementary treatment which aims at expounding fundamentals;" and the presentation has been designed so that the student without extensive mathematical training "may become familiar with statistical processes and [may] *acquire a working knowledge of the limitations in the use of such processes in economic analyses.*"[1]

The authors' objective is stated here, and the book should be judged by its success in reaching this objective. It is designed for students of economics, it is an elementary text, it aims to expound fundamentals and to stress the limitations of statistical methods. Otherwise stated, and frequently emphasized in other places in the text, the authors have not written for the specialist-to-be, but rather for the vast multitude of students who are to be business men or informed citizens and who want guidance in the interpretation of the economic facts that picture our daily economic life. It is a proper objective and one which has not been reached by the five-foot shelf of elementary statistics texts already on the market. This is not to say that all the effort expended in writing elementary texts has been wasted, for it is recognized that the ultimate ideal, in this as in any other field, does not spring full-grown from a single brain but develops gradually out of the composite experiences of many workers as their experience broadens and their objective clarifies. For one must not forget that, when Yule's and Bowley's texts were first published, statistics was an infant *science*, the tool of a few trained mathematicians, and its uses in interpreting data in the social sciences had hardly begun.

The five-foot shelf is partly an answer to this need of a rapidly expanding student body in the last 25 years in social science departments and schools of business; but it has grown partly for another reason to which passing reference may be made. With the existing pressure from university administrations to write and "produce" as a prerequisite to promotion, it has

[1] Preface, p. v, italics added.

seemed the proper thing to do, after about three years of teaching the elementary course, to write a "text" and thus become an "authority" in the field. This sort of thing is almost certain to reveal itself in the pages of any such text. There is no reason, internal or otherwise, to suspect that this text had any such pressure behind it. The "principles" of the subject are soundly presented; there is a balanced stress upon calculation technique and methods of obtaining numerical accuracy. The promise of the preface that the book will expound fundamentals and stress the limitations of statistical methods is a promise of something more than lines the pages of most of the five-foot shelf, and it is this promise that marks the book, in the mind of the reviewer, as something different. The extent to which this promise has been fulfilled is considered in the comments which follow.

Part I is a good discussion of the nature of statistical data, their sources, methods of collection, tabulation, and charting. In Chapter II on variables and homogeneity, the paragraphs devoted to rates give many illustrations but might have given greater emphasis to the logical relationship which must exist between numerator and denominator and the consequent limitations in the uses to which such ratios may be put. The distinction between general and specific death rates illustrates what is meant. The section of this chapter dealing with homogeneity occupies about 11 pages. It is good—both the fact of early emphasis and the discussion of homogeneity itself. There remains a suspicion, after having read the book through, that the authors left the subject pretty much at this point and did not feel the necessity of reverting to it repeatedly in later parts of the book. The discussion of charting covers 60 pages, a brief space in which to go deeply into the whys and wherefores of different charts. But the authors have done a satisfactory job. Emphasis has been placed on a reasonably small number of graphic devices that are best suited to show the several varieties of statistical magnitudes or series.

Part II, on general analytical methods, is devoted to the exposition of descriptive characteristics of the frequency distribution and of bivariate correlation. The introductory chapter states that the object of Part II will be (1) to describe methods of analysis, (2) to explain assumptions upon which they rest, and (3) to set forth the limitations to their practical applications. In this, it seems to the reviewer, the results do not sufficiently bear out the promise. The several types of averages are described in the traditional manner after quoting Yule's well-known six characteristics of a good average and apparently accepting them as a basis of choice. The statement that "in general the arithmetic average surpasses other types in fulfilling the above requirements" indicates an uncritical acceptance of these authoritarian standards and a consequent failure to seek a more profound basis for the choice between different measures of type. Nowhere in this discussion is there found a consideration of different *types* of frequency distributions for homogeneous data, no sufficient emphasis upon homogeneity as fundamental to the emergence of whatever type, nor is a given average associated with any given type. There is no adequate discussion of the prob-

lem of sampling, even in its most elementary aspects, and no attempt to relate the selection of averages to that problem, unless indeed the listing of Yule's fifth characteristic can be considered to cover the point. This weakness of the discussion shows up in the selection of illustrations in Chapter X, they being almost wholly from "categorical" series, as the authors call them. Chapter XI begins by recognizing this fact and then remarks that "the theoretical aspects of the problem of averages and the proper limitations upon the use of averages can best be studied in connection with frequency distributions." It would better have been said "can *only* be studied in connection with frequency distributions." The objections to this part of the text are stated strongly and after due deliberation. They arise from a belief that the many failures of statistical analysis to produce the results in economics that were optimistically expected 20 years ago are due to the failure to recognize and to emphasize, in every application, the rigid limitations under which various techniques are valid. Thus, the arithmetic average may be a proper measure of central tendency in a population or universe distributed in a known way, and the averages of random samples from this population may be distributed in a known distribution. With this sort of proposition as a start, the practical statistician who proposes to use the arithmetic average as a measure of type must now consider to what extent his actual population approximates the hypothetical one and, equally, to what extent his sample, if such it be, approximates the hypothetical random sample. When he discovers that these approximations are not very close he will be on guard against assuming that the actual will follow the hypothetical model. Statistical forecasting would not be in its present state of low repute if there had been more conservatism in applying the precise tools of statistics to actual problems.

There is a chapter in this section on the normal law, but it is a lone tree in a forest of a totally different sort, and the student will find great difficulty in discovering its connection with the other chapters of Part II. The few remarks here on random sampling are not related to what has gone before nor to what follows. The character of this criticism should not be misunderstood. The material in the chapter is excellent; for example, the introductory paragraphs indicating the causal nature of the forces producing variation according to the normal law. The fault, as the reviewer sees it, is, here as elsewhere, not what has been included but what has been omitted. It is a pleasure to call attention to one exception to this apparently general rule. At the end of Chapter XV emphasis is placed upon the conditions that must be satisfied for correlation analysis to be significant.

The final chapter of this part, on further methods of correlation, is almost too brief to justify its inclusion—one page on the correlation ratio, one on spurious correlation (Pearson's case of variables and ratios), and two and a half pages of text and formulas on partial correlation.

Part III of the book is devoted to time series analysis. Two chapters on index numbers give a good exposition of elementary index number theory,

following fairly traditional lines. Attention frequently is called to the differing views on moot points of the theory. One worthy position they take—they do not accept general-purpose index numbers as a jack-of-all-trades.

The remaining chapters are devoted to measurement of trend, seasonal and cycle influences, and to the discussion of forecasting sequences. This entire section follows essentially the technical methods worked out by Professor Persons. In the discussion of trend, excellent emphasis is placed upon the selection of a proper time interval; of trend curves, those given consideration are (1) linear, (2) constant-rate exponential, and (3) parabola. Seasonal measurement follows the pattern of Persons' link-relative method, with a very good emphasis on Persons' two preliminary methods of testing whether a significant seasonal is present in the data. Methods of isolating cycles likewise follow Persons.

The exposition of these several techniques is well done. The authors suggest and illustrate short-cuts in calculation, although they have not always given the most satisfactory short-cuts. For example, they do not show how linear, parabola, and exponential trends may be built up from differences expressed in terms of the parameters of the equation. In the calculation of the seasonal they make the trend correction upon the chained logarithms, whereas a simpler process, worked out years ago in the Harvard Bureau, makes the correction before chaining. These are but minor deficiencies.

Despite the high quality of the exposition in Part III it suffers from the serious defect inherited from Part II, the failure to give a sound foundation for a theory of averages. For the analysis of time series is replete with applications of average theory and the terrain is filled with quicksand. No mention is made, for instance, of the implications of the least-squares method of fitting trend lines, and, therefore, no proper emphasis is placed on the approximate character of the derived trend. This, along with the fact that the logical justification for linear, exponential, or parabolic trends is not investigated, leaves the student of the text in danger of just the sort of misinterpretation of economic trends that has been so characteristic of the past 20 years. These defects reach their culmination in the last chapter, on lagging correlation and forecasting sequence, in which the authors actually quote with approval the Harvard A.B.C. curves as a forecasting sequence. It is difficult to believe, for one who heard Professor Persons' presidential address before the Statistical Association, that he would approve of such use of the curves.

Bruce D. Mudgett

University of Minnesota

Business Statistics, by John R. Riggleman and Ira N. Frisbee. New York and London: McGraw-Hill Book Company, Inc. Second Edition, 1938. xix, 790 pp. $4.00.

The first edition of this textbook in statistical methods and their applica-

tion was reviewed in the December 1932 issue of this JOURNAL. A brief review of the new edition, therefore, is sufficient despite the unusual merit of the book. The basic organization of the earlier edition has been maintained, but there are some rearrangements and additions. A fuller discussion of index numbers, long-time trends, business cycles, and machine tabulation is provided. Charts and data have been brought up to date except where information for previous periods remains more satisfactory. A chapter has been added on the normal curve, probable error, and the problem of sampling, and this discussion is followed by the chapter on correlation which has been moved ahead of four chapters on the analysis of time series. About half of the book is devoted to problems that the statistician encounters in business forecasting, budgeting, population, purchasing power, production, labor statistics, marketing, real estate, investments, banking, and management. Other applications of statistics are considered along with the discussions of the techniques. Appendix IV contains a 22-page outline for industrial and commercial surveys together with an equally full outline of sources of data. Other appendices pertain to questionnaires, use of recording, calculating and tabulating machines, statistical drafting, preparation of statistical reports, business-cycle and building-cycle data, logarithms, squares, square roots, and reciprocals of numbers. An extensive bibliography is given at the end of the book. Each of the 25 chapters ends with questions and problems for review and amplification of the material presented.

Undoubtedly one of the shortcomings of the usual textbooks in statistical methods is their failure to show how the methods can be applied logically and effectively to the solution of problems. It is the usual practice to devote a chapter in general terms to the misuse of statistical methods. The book under review, however, shows the pitfalls in connection with each application.

Those who desire emphasis on application will probably not find a more suitable work in statistics. Statistical techniques described, however, are so elementary that a little knowledge of algebra plus the ability to learn the use of logarithms is adequate for their understanding. In fact, somewhat too much simplification is introduced on these points. Instead of some of the meticulous detail on minor aspects of application, a discussion of further points of analysis would have given a better balance. Partial and multiple correlation, so widely used, are dismissed in five lines without a suggestion of the problem involved or of the general approach to its solution. Surely a page or two indicating the extension of association beyond a single pair of factors would not be too advanced for one who should apply methods as skillfully as the authors presume. The application aspect also is weakened, especially in the chapter on correlation, by the unnecessary use of hypothetical data. Despite these criticisms an unusually high standard of presentation is maintained. Charts are a model of perfection. A competent instructor should have no difficulty in overcoming whatever deficiencies in technique exist.

WILBERT G. FRITZ

University of Pittsburgh

Statistical Methods, by George W. Snedecor. Ames: The Collegiate Press, Inc. 2d edition, 1938. xiii, 388 pp. $3.75.

A four-word description might well be "Fisher in the vulgate." The fact that a second edition is called for already is confirmation of the conjecture made last year that the book would enjoy a widespread adoption as a text. The style is lucid and colloquial, and anyone who has forgotten even a large part of his college algebra will have no difficulty following the arguments and learning to apply the technics: from that standpoint the book is an undoubted success. Yet such weapons in the hands of persons who are not such expert experimentalists as Mr. Snedecor, are apt to do more harm than good; nowhere in the book is there any attention given to the question, "When do these methods apply?" Until randomness is established there is more to an experiment than simply the numbers that are recorded. A physicist often takes hundreds of observations while perfecting his apparatus, recording nothing at all; then, when he is satisfied, records six observations. Yet these six are worth more than six million taken earlier in the experiment, because only those at the end are amenable to the statistical treatments advocated. Mr. Snedecor's assumption is that a parent population necessarily exists. Others insist that the parent population must be created. Whether it is normal or nearly normal is not so much of a worry as whether it exists at all; it does not until the steady state of statistical control has been attained. Usually this is a matter of long and careful experimentation with control chart technic.

It is pleasing to see the following advice on page 333 regarding curve fitting: "Only when the end in view is clear should the task be undertaken. Often a graph of the data points is sufficient." But on the next page, the avoidance of "eye-fitted" curves runs counter to the advice and practice of many men of equally long experience.

Before statistics can enjoy company with the natural sciences as an equal, the subject must be developed into a science. No statement has any scientific value unless it can be put to a test. When one reads on page 54 that "in practice the experiment is seldom repeated" one wonders just how to interpret the frequently recurring statement that "this latter would be expected to occur only once in 100 samples" (page 58 and elsewhere). If experiments are not usually repeated, any statement concerning the next 100 repetitions is perfectly safe but not scientific. When one reads, on page 59, that "the best estimate we have is 6 bushels," is he to infer that future experiments will average 6 bushels or anything like 6 bushels? An estimate conveys no knowledge without an accompanying statement of the number of observations on which it is based and the evidence for control, but I find no admonition that this additional information needs to be furnished in the statistical summary of a report. One might be thoroughly convinced of the validity of Student's theory, yet is he to the good if he is told (page 63) that the 95 per cent fiducial limits of the difference in yield are 4.95 and 7.05 bushels? If these are based on 4 *d.f.*, the statement conveys scarcely any knowledge

concerning the real difference; if it is based on 100 *d.f.*, it conveys quite a little, provided control has been established and proved, the reason being that in large samples, in control the fiducial limits stay close to the ideal limits that cut off the calculated percentages from the population itself. The careful experimenter knows instinctively that there must be a distinction between the statistical calculations of large and small samples, but modern textbooks do not tell him why, and he justifiably becomes skeptical of statistics.

A large portion of the book is occupied with tests of hypotheses but without any discussion of how a test should be selected; the fundamental researches of Neyman and Pearson in this regard seem to be completely overlooked. If there is no plausible alternative to the hypothesis under test, there is no use making the test.

To continue with some minor criticisms in the same vein, I should say that there are some unintentional errors in history; the first calculation of a pair of confidence or fiducial limits was made by E. B. Wilson in 1927 rather than by Fisher in 1930 (pages 63). The analysis of variance, not in name but in thought, goes back at least to 1912, as is evident from pages 67–71 of Palmer's *Theory of Measurements* (1912)—indeed, the idea goes back to the correlation ratio introduced by Karl Pearson in 1905. On page 33 Mr. Snedecor attributes the factor $n/(n-1)$ to Student in 1908, and on page 54, apparently to Bessel, no mention being made of the fact that Gauss in 1823 very clearly subtracted the number of unknowns evaluated from the number of observations to get the corrected denominator (number of "degrees of freedom") in an estimate of the population variance. Contrary to the statement on page 33, Student apparently was not concerned about the average value of s^2 nor the appearance of $n-1$. Moreover, it was Helmert in 1876, not Student in 1908, who first derived the distribution of s. In the face of these things, it is a pleasure to see the solution by the reciprocal matrix (page 288) duly credited to Gauss and not made a modern invention as many writers have done; no mention is made, however, of the disconcerting fact that, when some of the betas are very small, this method breaks down.

In the table of chi squares on page 10 and in fig. 1.1, the author might have pointed out that, with 20 items, chi square can take only the 11 values 0, 0.2, 0.6, 1.8, . . . , 16.2, 20; the discontinuous nature of chi square, not chance, is responsible for the empty cell of class 1–1.49, as it is also elsewhere. In his treatment of least squares, the author fails to point out that in his formulas the error is assumed to be all in the y co-ordinate.

It is always easy to find fault. The fact is that I have found the book to be of great assistance for reference, and I take pleasure in recommending it as a text, provided sufficient attention is given to guided supplemental reading to obtain perspective; the contents would then be ample for a year's course with students who already possess some training in one of the natural sciences.

W. EDWARDS DEMING

Bureau of Chemistry and Soils
U. S. Department of Agriculture

Statistical Methods for Research Workers (Seventh Edition), by R. A. Fisher. Edinburgh and London: Oliver and Boyd, Ltd. Biological Monographs and Manuals, No. V. 1938. xv, 356 pp. 15/–.

Professor Fisher's handbook of practical statistical methods continues to grow with the volume of theoretical research that has been built up by him and others, though it cannot possibly keep pace, as to detailed illustrations, with the rapidly widening fields of application of these methods. It is, of course, designed primarily for biologists, including agricultural and medical research workers; but the methods recommended and illustrated form a suitable basis for statistical methods to be used in psychology, economics, sociology, meteorology, and other fields; indeed, some of the illustrations are drawn from these subjects. The economist is faced with difficult problems in the development of statistical methods appropriate to his excessively bad data; but I am convinced that these methods must be based essentially on the methods outlined in the volume under review, with modifications necessitated by particular conditions, and cannot usefully be constructed, or even understood, without reference to the body of sampling and probability theory that underlies Fisher's methods.

Among the features introduced into the book for the first time with this edition are a fuller and clearer exposition of the basic ideas of orthogonal polynomials, which are an indispensable tool in the analysis of time series, and a new section on the use of multiple measurements in statistical analysis. This latter subject is one that has had a rapid recent development, not yet complete, in which there have been brought to light novel and very powerful methods for dealing with sets of different variates. The mathematical developments of multivariate statistical analysis that have been evolved in this country and in India have resulted in part from inspiration emanating from Professor Fisher; he, in turn, has found ingenious ways of fitting them into his system and of turning them to practical account. Much of the theory is, however, purely his own; this is particularly the case with the determination of the "discriminant function" which he describes on pages 294–97. Another remarkable and novel scheme for dealing with tables of non-numerical data is described and illustrated by serological observations of five types, with the suggestion that it might be applied also to many other situations, including the study of family budget data, where weights are to be determined from the data for the various types of families. This procedure involves the numerical solution of a determinantal equation and seems to have subtle points of relationship both with the "factor analysis" of the psychologists and with the problems which I have dealt with under the head of "Relations between Two Sets of Variates" (*Biometrika*, 1936, pages 321–77) without, however, duplicating this or other past work.

The treatment of the problems of multivariate analysis given in the book is necessarily extremely brief, and the reader who wishes to get a clear understanding of methods other than those explicitly illustrated will do well to read various journal articles, particularly several recent ones by

Professor Fisher and his collaborators and students in the *Annals of Eugenics*. Of these, his recent (1938) paper on "The Statistical Utilization of Multiple Measurements" clarifies various matters connected with the discriminant function, while previous empirical papers by Miss M. M. Barnard, B. Day, and others supply illustrations.

Because of the expanded size of the book and the publication of the new Fisher and Yates tables,[1] the duplicate folding tables in the back of the book have now been abandoned. The discussion of the design of experiments is left unamplified in this book because of the author's recent publication of a fuller book on the subject.

HAROLD HOTELLING

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An Introduction to Modern Statistical Methods, by Paul R. Rider. New York. John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1939. ix, 220 pp. $2.75.

The first part of the title given above is really superfluous and perhaps misleading, for the book is more than an introduction. It is very comprehensive in spite of its small size. The chapter titles indicate fairly well its scope: Frequency Distributions, Averages and Moments, Regression, Correlation, The Binomial and Normal Distributions, Student's Distribution, The Chi-Square Distribution, Analysis of Variance, and Experimental Design. The treatment of most subjects is quite brief and very concise, but the research worker will find in the book a good treatment of almost every technique he needs.

The book is written from the viewpoint of the mathematician and might be termed a textbook on mathematical statistics rather than practical business or economic statistics. In the preface Professor Rider writes: "Fisher's efficient methods, at first slow in taking hold, because not thoroughly understood, gradually began to gain momentum, and are now spreading rapidly. In this book I have endeavored to explain the most widely used of these methods, illustrating their application by comparatively simple numerical examples, so that the underlying principles are not lost sight of in a maze of arithmetical computations. The earlier chapters develop the fundamental concepts of statistics, so that the book is suitable as a textbook for a first course in the subject. It is also planned for those with some knowledge of the subject who wish to gain an insight into the more modern methods, as it leads from the classical concepts, through such topics as "Student's" distribution and the chi-square distribution, to the analysis of variance and the design of experiments, which are the culminating features of Fisher's work."

[1] Reviewed in this JOURNAL for March, 1939, pages 206–07, by G. W. Snedecor.

Additional evidence of a mathematical viewpoint is the fact that on page 5 the reader encounters the integral sign and on pages 27–28 he reads, "Employing the usual methods of the calculus, we differentiate partially . . . ." These illustrations are not included as a criticism but to illustrate the fact that this text is not another of the many attempts to write a textbook for students who have not had more than three hours of college algebra. This textbook probably will be more satisfactory for statistics courses given in departments of mathematics or agriculture than for statistics courses given in schools of business, for the book does not mention seasonal variation, business cycles, or index numbers—probably because these are practical applications of statistical methods in the field of business or because R. A. Fisher did not devote much attention to them.

Harry Pelle Hartkemeier

University of Missouri

Research in Agricultural Index Numbers—Scope and Method, by John D. Black and Bruce D. Mudgett. New York: Social Science Research Council. Bulletin No. 10. Prepared under the direction of the Advisory Committee on Social and Economic Research in Agriculture. March, 1938, viii, 152 pp. 75 cents.

This bulletin concludes the series of 21 reports on scope and method of research in the field of agricultural economics as planned by the Advisory Committee on Agriculture of the Social Science Research Council. It centers around a report on index numbers submitted as early as 1929 by Professor Mudgett. He is a strong believer in Fisher's Ideal Index formula, advocating its application in chain fashion for comparisons between nonconsecutive periods. The editor, Professor Black, has ingeniously avoided stressing a single viewpoint in such a controversial matter. Instead, the reader is led into a stimulating and lively seminar on index number methodology and computation. The members are the reviewer's committee of Professor Mudgett's report, composed of Professors Irving Fisher, W. I. King, F. C. Mills, Warren Persons, and Dr. O. C. Stine. The contributions of these experts to the various phases of the index-number problem are supplemented by the general literature of the subject and the studies conducted by the Committee on Government Statistics and Information Services under the direction of Dr. Murray R. Benedict and Dr. Henry B. Arthur. Anyone faced with a practical index-number problem will profitably follow the unfolding of the pros and cons for selecting a particular type of formula or base years and for depending upon tests of reliability warranted by the specific purpose which the index is to fulfill.

The group in charge of the preparation of this report "wishes to be understood as not espousing any particular form or type of index numbers as best suited to any and all situations and objectives," and the report seems to be

skeptical as to whether a measure of "pure price change" is possible at all. But it implies that, to fit a particular purpose or a particular period, particular index numbers can give adequate answers. Thus the reader is put in the position of deciding which procedure fits his specific problem. There seems to be consensus that Fisher's Ideal Index formula is the best to be used if the purpose is to show changes in prices of commodities as they are marketed. In spite of the well-known theoretical reasons and the practical expediency in favor of fixed-weight indexes, the report suggests that, for long-term indexes at least, the computation of price indexes weighted according to production in each year is needed, if only for comparisons. In the examples given in the report the differences are as a rule very small. The reviewer has found, in recently completed long-term farm price and production indexes for the United States, that for large groups of farm products the discrepancies between indexes based on Laspeyre's formula and those based on Paasche's formula are in general small; but they are significant in years in which the production ratios (in the price index) and the price ratios (in the production index) change. The discrepancies are notable in subgroup indexes composed of farm products with greatly changing yields or of products whose importance shifts noticeably in the long run.

More than half of the Bulletin is devoted to index-number methodology. The special problems connected with agricultural index numbers are indicated. But the general index number questions are treated so exhaustively and clearly as to make the report as indispensable for index-number students as Professor Mitchell's standard investigation on *The Making and Using of Index Numbers* (recently reprinted as Bulletin 656 of the U. S. Department of Labor).

The second major part contains a detailed description and evaluation of existing index numbers in the agricultural field and a number of suggestions as to further research. This part enables the reader to draw his own conclusions by comparing the results obtained by the application of different methods with the methodological exposition. Altogether, this monograph will serve its intended purposes well and may go far to influence index-number research in the proper direction.

FREDERICK STRAUSS

Washington, D.C.

Collection and Presentation of Statistical Data in Psychology and Education, by Martin F. Fritz. New York: Prentice-Hall, Inc. 1939. vi, 58 pp. 65 cents.

This little book might be called a preprimer among books on statistics. It does not go into the calculation of any statistical measures. Neither does it discuss the use and limitation of such measures. The author has gathered together a body of first principles in the collection and presentation of statistical data that has not been so adequately organized and so forcefully

stated in any single text to the reviewer's knowledge. Illustrative material is well chosen and presented in good form. A short but well selected bibliography is appended. The book is definitely for the uninitiated, but it should prove a welcome supplement to most introductory texts and a valuable handbook for those who dabble with statistical data.

Mary V. Louden

University of Pittsburgh

Wholesale Commodity Prices in the United States 1700–1861, by Arthur Harrison Cole. Cambridge: Harvard University Press. London: Humphrey Milford, Oxford University Press. 1938. Textual Volume, xxiii, 187 pp. $4.00. Statistical Supplement, x, 359 pp. $2.50.

At the instance of Professor Edwin F. Gay of Harvard University and Sir William Beveridge of the London School of Economics, the International Scientific Committee on Price History was organized in 1929 to study price and wage movements and related monetary and meteorological phenomena in different nations. The primary intent was to secure comparable basic data covering long periods of time and then to present such data in a form suitable for use by research workers. Sir William Beveridge was made chairman of the Committee. The Rockefeller Foundation furnished financial support, and investigations were simultaneously undertaken in Germany, France, Austria, the Netherlands, Spain, Poland, and the United States. The direction of the work in the last-mentioned country was assigned to Professor Arthur H. Cole of Harvard University.

The collection of data in the United States has been carried on mainly in six localities and has been confined primarily to a study of prices at wholesale, though some retail price data have been compiled for the Philadelphia area. Those directing the inquiries have been: Boston, Miss Ruth Crandall; New York, Professors Warren and Pearson and Dr. H. M. Stoker, all of Cornell University; Philadelphia, Professor Anne Bezanson of the University of Pennsylvania; Charleston and New Orleans, Professor G. R. Taylor of Amherst College; Cincinnati, Mr. Thomas S. Berry of Duke University.

The Committee has utilized not only continuous data but also fragmentary sources. Monthly quotations for three commodities have been secured by Miss Crandall for Boston from 1752 to 1774 and from 1784 to 1795, inclusive. For New York, Dr. Stoker has constructed a weighted index of the prices of 15 commodities running continuously from 1748 to 1781 and from 1793 to 1800. This series has been connected with the one previously made by Professors Warren and Pearson, who had collected continuous monthly data for at least 116 commodities during the period 1797 to 1861. Professor Bezanson has succeeded in obtaining quotations on 20 commodities at Philadelphia for nearly all years from 1720 to 1775; for 186 commodities from 1874 to 1794; and for 205 commodities from 1795 to 1860. Professor Taylor has been able to construct a price index for Charleston beginning in

1732 with six commodities and gradually increasing to 16 commodities for the period 1762–75. He has also extended his index with 44 commodities from 1780 to 1861. In addition, he has secured quotations on a few commodities at New Orleans for the years 1804 to 1812 and for 49 commodities at the same city for the period 1815 to 1861. Furthermore, Mr. Taylor has obtained price data for 21 commodities at Cincinnati from 1816 to 1825; for 37 commodities from 1824 to 1846; and for 50 commodities from 1846 to 1860.

In the textual volume, index numbers computed by such formulae as weighted and unweighted arithmetic, and weighted and unweighted geometric averages are set forth. In so far as possible, the data are tabulated on a monthly basis. Charts are presented comparing the price fluctuations at the different cities. The statistical supplement contains no analysis of the figures, but merely presents the actual monthly quotations, and occasional interpolations, for the specific commodities used in compiling the various index series given in the textual volume.

The international Committee, Professor Cole, and those doing the research are to be heartily congratulated on the completion of the arduous task of collecting this great mass of American price data and putting it into a form so convenient for use by statisticians.

WILLFORD I. KING

New York University

Statistical Abstract for the United Kingdom, for each of the fifteen years 1913 and 1924 to 1937. London: His Majesty's Stationery Office. New York: The British Library of Information. Eighty-second number, 1939. xvii, 453 pp. $2.00.

In recent years there has been considerable interest in comparisons of economic progress and development as between major countries. Any study of Great Britain's position should, of course, start with an examination of the available statistics, and these are to be found in the most convenient form in the volume under review. This volume contains a considerable amount of statistics covering many important fundamental subjects: population, employment and unemployment, national finance, banking, currency and wholesale prices, industrial production, trade and commerce, and so on.

Certain subjects are not fully covered in the Statistical Abstract, and for a complete picture of economic conditions in the United Kingdom it is necessary to consult other sources. For example, the Abstract provides no data on British national income. While not official, the national income estimates of Mr. Colin Clark, contained in his *National Income and Outlay* (1937), are widely used. The building boom in Great Britain has commanded great attention. Data on the number of houses built with and without state assistance may be found in the Statistical Abstract, but the equally im-

portant figures on the value of building plans approved by 146 local authorities will have to be secured from the *Abstract of Labour Statistics of the United Kingdom*. Quarterly index numbers of industrial production published in the *Board of Trade Journal* are contained in the Statistical Abstract. No reference is made to the monthly indexes of business activity published in the *Economist*. The wholesale price indexes of the *Board of Trade Journal* may be found in the Abstract, but the indexes compiled by the *Statist* and the *Economist* are not given.

The volume under review is considerably smaller than its American counterpart, *The Statistical Abstract of the United States*, principally because of the greater amount of statistical data gathered in the United States. The compilers of the American handbook, however, have availed themselves of much more material provided by private organizations than have the British.

Harrison F. Houghton

National Industrial Conference Board

Selected Information on Steel Producers with Assets over $100,000,000 Each, Registered under the Securities Exchange Act of 1934 at June 30, 1938. Washington, D.C.: Securities and Exchange Commission. A Works Progress Administration Project. Report No. 1. November, 1938. v, 63 pp.

This report is the first of a series of studies based on the Census of American Listed Corporations. Similar reports covering meat packers, chain variety stores, automboile manufacturers, producers of tires and other rubber products, manufacturers of agricultural implements, cigarette makers, sugar refiners, mail order houses, and oil refiners had been issued by the end of April. Other forthcoming studies probably will cover office machinery, industrial machinery, automobile parts and accessories, cement, chemicals, containers other than paper, chain grocery stores, department stores, and motion picture producers. Because the Securities and Exchange Commission has in its possession a great deal of significant data which would not be readily accessible to the general public, these reports are being compiled covering the basic data and ratios and percentages derived therefrom, with the expectation that they will be useful to students of the respective industries. The following comments on the steel data are generally applicable to all the reports thus far released:

Nonfinancial data include a list of the subsidiaries of the 12 companies covered by the report (actually only 10 companies because two of the United States Steel Corporation subsidiaries are listed separately from the parent company); a list of all security issues outstanding; the amounts of the three highest remunerations reported by each registrant; and the remunerations reported for all officers and directors in total. The majority of the tabulations presented are of a financial nature, e.g., balance sheets, profit and loss state-

ments, selected expense items, and surplus reconciliations. These figures are given in a combined form for the companies as a group as well as for each company separately. In addition, 16 financial ratios computed from the basic data are presented. The companies covered by the report control roughly four-fifths of the country's steel ingot producing capacity. For persons interested in the financial conditions of the major steel companies, these data, which are presented in most instances for the years 1934, 1935, 1936, and 1937, should be very useful.

MARION W. WORTHING

United States Steel Corporation

Des Crises Générales et Périodiques de Surproduction, by Jean Lescure. Tome I: Le Phenomene. Tome II: Causes et Remédes. Paris: Les Editions Domat-Montchrestien. F. Loviton & Cie. 1938. xvi, 702 pp. 100 fr.

The first volume is a history of cycles from 1810 up to the present. The author comments briefly on each of the upswings, collapses, and depressions which have occurred during these 2½ long cycles. The second volume deals with causes and remedies.

Lescure divides theories of the business cycle in two large groups: theories concerned mainly with the phenomena of money circulation and theories which emphasize production, consumption, and distribution. The second group is further divided into "organic" and "inorganic" theories, the former attributing crises to certain features of *capitalism*. The author derives his conclusions from a historic analysis and from facts reflected in contemporary statistics.

The upswing ends when the increase in selling prices becomes insufficient to offset the increase in costs, Lescure states. In some industries the shrinkage of profits precedes the general crisis; in others it coincides with it. How does this discrepancy between the increase of costs and that of selling prices come about? "D'où vient donc cette impossibilité de récupérer dans la vente le coût de production? Elle peut tenir soit au consommateur, soit au producteur. Le consommateur ne veut plus ou ne peut plus consommer—le producteur a trop produit. En realité, le plus généralement, les deux phénomènes se combinent: l'entrepreneur s'adresse à une consommation de moins en moins disposée, à mesure qu'il étend sa production: *l'intensité du service rendu, du besoin satisfait, a une tendance à diminuer. Les premiers entrepreneurs se sont adressés en général aux consommateurs les mieux disposés.*" If a decreasing marginal propensity to consume and a functional relationship between consumption and investment are stressed here, then the treatment is not very precise. And yet how else could the above statement be interpreted? Apart from the repeated appearance of this rather indistinct idea, there is an explanation based on losses occurring through the increase of costs in industries subject to fixed selling rates. These losses upset the equilibrium of the system and therefore have a tendency to spread throughout the economy.

With respect to cycle policy the author holds that the control of the credit-creating activity of the banking system would have a mitigating effect and that, in times of depression, a public-works policy might be advantageous. He expresses the opinion that the central banks ought to hold large volumes of foreign assets, since otherwise drastic and harmful measures must be taken in certain cases in order to avoid a currency crisis. For similar reasons the author favors the policy of a "premium on gold," which essentially amounts to the widening of the range between the gold points.

William Fellner

Berkeley, California

The Causes of Economic Fluctuations, Possibilities of Anticipation and Control, by Willford I. King. New York: The Ronald Press Company. 1938. xv, 353 pp. $3.50.

This book is the expression of Professor King's belief that economic science has advanced far enough to enable it to answer the question as to the essential causes of economic fluctuations and the possibilities of alleviation and to do it in simple enough terms to be available to the average reader. The author steers a middle course between the unduly simple interpretations of fluctuations which run in terms of a single cause and are unconcerned with the complexities of the full factual picture and the opposite method which builds up a formidable mass of descriptive material and statistical analysis, the interpretation of which the average reader is hardly equipped to follow. In his early discussion of the facts, he is mainly concerned with the more violent and spectacular fluctuations, with emphasis on speculative booms and crises and their psychological concomitants. Later, when he is discussing measures of policy, he recognizes the shorter cycles of an average duration of 41 months, many of which do not share the more conspicuous features of the more violent disturbances. As a result, this phase of his treatment has the appearance of resting on an inadequate factual basis. The factual picture is simple enough to enable the author to say that the pattern is essentially the same at different times and places. The main existing theories are discussed, more in the spirit of disposing of the unsound ones than of searching for the elements of truth they may contain. There is also a chapter on forecasting.

In the author's own theory, fluctuations of solar radiation and their possible psychological effects play a very large part. As to the reasons why the economic system responds as it does, Dr. King emphasizes movements of mass psychology, the elastic credit system and rigidities in the wage and price structure. Tendencies to concentrated buying of durables, and the "multiplier" effect, come into the picture but in rather incidental ways. Oversaving and maldistribution of incomes are dismissed among the unsound theories, on grounds which will probably not appear to economists in general as definitive.

The treatment of remedies is in general harmony with this attitude and emphasis as to causes. It is conservative to state that Dr. King does not unreservedly approve all elements of the "New Deal." He doubts the efficacy of deficit spending, even as an immediate stimulus, and condemns unqualifiedly the policy of high wage rates during depressions and of easy made-work at high hourly wage rates as a form of relief. While his strictures on this last have force, he is surely wrong in assuming or implying (page 191) that the program diverted all its employes from private industry. He would substitute a policy so "hard-boiled" as to appear hardly practicable. He favors also the Graham plan of self-sufficing production by the otherwise unemployed, speaking of it as if it had not been tried at all, and assuming that it could sustain the unemployed without financial cost to the Government. This last appears unwarranted, on such analysis as the reviewer has been able to make.

The positive program rests mainly on 100 per cent reserve banking, combined with open-market operations on a greatly increased scale and on flexible wages and prices. His faith in the adequacy of flexible prices as a stabilizer appears too absolute, as does his faith in the adequacy of flexible interest rates to insure that there shall be no discrepancies between savings accumulated and the amounts industry puts to productive uses. As to flexible wages, various interesting ideas are suggested, looking toward stabilized real annual earnings. But the whole seems to rest on an unduly simple concept of the shape of the demand function for labor as a whole. Held in reserve if other things fail is an interesting proposal for outright planned production, concentrating on production of consumers' goods and leaving stabilized demand for durable productive equipment to come about automatically as a by-product (though a provisional suggestion is made for limiting demand in boom times).

One point of detail might be noted. On page 111, Dr. King cites Irving Fisher's demonstration that the curve of first differences of wholesale prices leads the curve of physical volume of trade. He avoids Fisher's conclusion but does not point out the selective nature of this comparison (the first derivative of a sine curve leads the curve itself by a quarter-cycle).

Dr. King's book will not resolve all unsettled questions as to business cycles, but that was hardly to be expected. If it is to be used as a text, there will be need of supplementary material to offset the author's controversial leanings. Perhaps the most general criticism of the book is that the author has not applied to the proposals he favors the same hard headed and skeptical scrutiny which he applies to our actual policies. But he has succeeded in producing a simple and readable study of business fluctuations, and that in itself is no small accomplishment.

J. M. CLARK

Columbia University

Consumer Incomes in the United States, Their Distribution in 1935–36. Washington, D. C.: National Resources Committee. 1938. vii, 104 pp. 30 cents.

Economists and statisticians have felt for a long time the need of reliable statistical information on the distribution of incomes in the United States. Of course, there exists a large body of data on the incomes of Federal income tax payers, published annually by the Treasury Department. But these data are limited to people having an income above the tax-exempt amount. The minimum amount of tax-exempt net income has varied since 1918 between $2,000 and $3,500 for families and between $1,000 and $1,500 for single individuals. Only rough estimates were available for the incomes of people below these limits. Previous studies made by the National Bureau of Economic Research and The Brookings Institution tried to fill this gap by adducing various and heterogeneous kinds of data on earnings of individual workers.

This report of the National Resources Committee furnishes a wealth of evidence about the complete distribution of family and individual incomes. What the inclusion of net incomes under the present limits of tax exemption means, can best be realized with the help of the following figures quoted from the report. In 1935–36, families with total gross incomes of less than $2,500 formed 87 per cent of the total families; they received 60 per cent of the aggregate family income. Single individuals with total incomes of less than $1,000 were 61 per cent of the total; they received 29 per cent of the aggregate income of single individuals. This is the first time we possess comprehensive and reasonably homogeneous information on the distribution of income in the United States.

The report is based primarily on data from the Study of Consumer Purchases, a W.P.A. project planned and conducted by the National Resources Committee, the Bureau of Home Economics, and the Bureau of Labor Statistics, with the co-operation of other Federal agencies. Information on incomes was obtained from a random sample of approximately 300,000 families living in cities and villages and on farms in 30 different states. Though the sample included only 1 per cent of the total number of families, the results obtained must be considered representative since the greatest effort has been made to secure its random character. Separate income distributions were established for groups of families, homogeneous with respect to type of community and region, color and nativity, relief status, family size and occupation. Then the total of families in the United States was split up into homogeneous groups comparable to those into which the sample was divided. The frequencies of families thus obtained were used to establish estimates of the population income distribution for each of these homogeneous groups. A correction of these distributions was found necessary: although random sampling methods were used, it was found that families in the higher income brackets were somewhat underrepresented. For this reason it was necessary to correct the income distribution by using

Federal income tax data. By combining the corrected distributions for the various groups, an estimated national distribution of family incomes was built up.

The income distribution for nearly 30 million families in the United States was supplemented by distributions for about 10 millions of single individuals and information about average incomes of "institutional residents." The report indicates that the figures on family incomes are probably more reliable than those for the two other groups of consumers.

Special attention is given to the characteristics of the families and single individuals forming the "Three Thirds of the Nation." The lower third comprises families and individuals with yearly incomes of less than $780 and the upper third with incomes of more than $1,450.

The report gives evidence of a very careful study. The group of research workers in charge of it, headed by Hildegarde Kneeland, merits high praise for this valuable contribution.

HORST MENDERSHAUSEN

Cowles Commission for
Research in Economics
and
Colorado College

Studies in Income and Wealth, Volume Two, by the Conference on Research in National Income and Wealth. New York: National Bureau of Economic Research. 1938. xii, 331 pp. $3.00.

This is the second set of co-operative studies on the nature of income and wealth, the first of which was reviewed in this JOURNAL in the issue of September, 1938. The general plan is that of a series of conferences, the papers and discussions at which are here reprinted after correction. Much of the usual task of the reviewer has already been done in the book itself, for each essay except the final one has been thoroughly criticized. In style of writing it is, of course, heterogeneous, ranging from the verbosity of Kuznets, the obscurity of Copeland, and the ponderosity of Haberler to the simplicity and clarity of Bye, Hewett, and Blough. There is some question whether the subject of economics has yet advanced to the place where it can afford treatises which are such hard reading. Certainly the contents of this volume are highly theoretical. The National Bureau of Economic Research and the scholars here represented have, most of them, been engaged in practical statistical studies of wealth and income and apparently feel the need of just such discussion as is here developed. Together with the first volume, however, this makes a rather long chain of deductive reasoning.

Unfortunately, the full value of the cumulation of discussion has not been realized. The contribution of the first volume, though often referred to, is as often overlooked. The same issues recur with little progress. The difficulty is that too many of the writers seem to be hobbled by at least one of the fun-

damental biases of orthodox economics, even when they have freed themselves from the others. Thus Copeland, even though he has thrown off the productivity concept of income, cannot get away from materialism, which deprecates the possibility of social value outside of physical objects.

Part one is "On the Measurement of National Wealth," by Simon Kuznets, with discussion by Bye, Colm, Copeland, and Martin. This paper by Kuznets is noteworthy for the cataloguing of the many variants of this concept. His skepticism concerning the importance of national wealth estimates is refreshing. Part two is "The Correction of Wealth and Income Estimates for Price Changes," by Copeland and Martin, with discussion by Bye, Fabricant, and Friedman. Part three is on "National Income, Saving, and Investment," by Haberler, with discussion by Copeland and Neisser. This paper by Haberler and the discussions thereon are concerned chiefly with the problem of the equality of savings and investment as posed by Keynes. Part four is on "Capital Gains in Income Theory and Taxation Policy," by Blough and Hewett, with discussion by Copeland, Groves, Kuznets, Simons, and May. This paper suffers somewhat from its dual authorship, embodying Hewett's definition of income as the flow of commodities and services and Blough's careful argument for the taxation of accrued rather than realized gains. The answer to the vital question, how shall capital gains be treated in the measurement of national income and of changes in national wealth, falls somewhere between the two approaches. Parts five and six are shorter and have to do with Government income as a part of national income. The papers are by Means, Currie, and Nathan and by Nelson and Jackson.

The reader can only hope, as he wades through this mass of words and ideas, that the writers are, like himself, actually being stimulated to more logical and more concrete concepts and that their subsequent volumes, if any, will show some convergence of thought. It is a hard row which has to be hoed, but some strong men are here shown actually at work on it. In this volume they reveal, at least, the exceeding difficulty of the task of defining and measuring national wealth.

Edgar Z. Palmer

University of Kentucky

The National Income of Australia, by Colin Clark and J. G. Crawford. Sydney and London: Angus & Robertson, Ltd. 1938. viii, 120 pp. 3/6.

In this small publication the authors have presented subject matter which might well fill two large volumes. In the first part of the book, definition of national income, methods of estimation, and results of the study for Australia are presented. The latter part of the publication deals with the relationship of the national income to public finance, investment and savings, the multiplier, and future policy. It would have been much more satisfying had considerably more space been given to the various topics, but credit

should be given to the authors for having presented so much in such a small volume.

Following a brief chapter defining national income in much the same manner as is done in the United States, separate estimates for income derived by the "received method" and by the "production method" are presented. The former rely primarily on income tax data supplemented by information on non-taxpayers' incomes. The two sets of estimates are remarkably similar. Yet the need for making certain arbitrary determinations makes the similarity somewhat less significant. It is difficult for the reader to follow numerous details of the methods of estimation because of brevity and even more difficult to evaluate the results because of the lack of adequate description of the source material. (Perhaps this difficulty should provide us with a lesson in the description of our own sources and methods.) Also, reliance is placed on other studies without comment as to the way in which such studies were conducted, size of sample used, or definition of the terms.

In developing the estimates by the "production method," the authors make no entries for income produced by banking, insurance, stockbroking, building societies, and other finance on the ground that interest paid to this group by other economic enterprises had already been included as part of the net product of the other enterprises and not as a cost item. This treatment is justifiable only to the extent that the financial group is servicing business enterprises. Certainly, in so far as services rendered by these financial organizations, or "aggregates of individuals," are for individuals as ultimate consumers, the value of their services should be included in the national income. In income studies in the United States, short-term interest payments of business enterprises are deducted as a cost and not considered as part of the net product. Long-term interest payments of business enterprises are included as part of the net product of these enterprises, whether paid directly to individuals or indirectly through these financial institutions. Presumably, the funds which individuals receive from life insurance companies and savings banks are not equal to the full amount of premiums and deposits plus the entire long-term interest receipts of the depositories, the difference representing the purchase by policyholders and depositors of the services rendered to them by these organizations. The treatment of this field results in a moderate understatement of the national income of Australia.

The treatment of government is not described in sufficient detail, but it appears that some deviation has occurred from the procedure followed in Clark's excellent book, *National Income and Outlay*. In that publication, Clark included not only the salaries, wages, and interest paid by government but also indirect taxes in the annual estimates of the national income. Inclusion of indirect taxes was justified on the basis of their affecting a corresponding rise in the price of articles or goods taxed. The same circumstance, however, might be accepted as a basis for including the net value of product and also gross receipts for private industries. Inclusion of indirect

taxes appears to be, at least in part, a matter of double counting, since the value of government services (valued at cost by the salaries, wages, and interest paid) has already been included. It is not double counting to the extent that the proportion of the total tax bill borne by producing units is greater than the proportion of the value of government services accruing to producing units. In the present volume, Clark and Crawford do not include indirect taxes in the money estimates. For comparisons of real income from year to year, however, indirect taxes have been added, since the price indexes used for price adjustment purposes include such taxes, which represent varying relationships to the national income in different years.

In the chapter on national income and public finance, taxes are discussed as a burden on the national income. This is unfortunate, in view of the fact that the value of services produced by government are included as part of the net product of the nation and in view of the whole problem of treating gross and net income distinctively. Certainly, such terminology can only add confusion to the relation of government activities to the national income.

In the chapter on investment and savings, an attempt is made to present estimates of investment by business and the Government. The authors define investment as "the quantity of new capital goods purchased." Consumers' durable goods are not included. Australian savings are defined as net investment less capital inflow from overseas. A discussion of the multiplier is related to four principle "short term determinants," namely, exports, investment, budget disequilibrium, and import replacement. A comparison of the calculated net influence of the determinants and the annual changes in the national income yields interesting results.

In the final chapter "National Income and Future Policy" the authors foresaw in the closing days of 1937, when the text was written, a decline in exports and a probable resulting decline in investment which would bring about a curtailed national income. It was suggested that the encouragement of government deficits might sustain the national income, but that "nobody seems to favor this method." Nevertheless, the authors suggest that such budget deficits be deliberately planned. This program is, however, pointed out as being a dangerous medium which may lead to uncontrolled inflation if made habitual. An analogy is drawn between government deficits and use of strychnine in the treatment of a heart attack. Such a policy has hardly been viewed similarly in the United States.

Robert R. Nathan

Bureau of Foreign and Domestic Commerce
U. S. Department of Commerce

The National Income of Hungary, 1924/25–1936/37, by Matthias Matolcsy and Stephen Varga. London: P. S. King & Son, Ltd. 1938. vii, 116 pp. 15*s*.

There are two distinct types of contribution to the national income literature, one concerned primarily with theory and concepts and the other with

actual measurement. In the former field, contributors are relatively uninhibited by mundane statistical considerations. In the latter, however, the national income estimators are in the delicate position of having to survey and map out passages between the whirling Charybdis of theoretical discord and the unyielding Scylla of chaotic source material. The recent tendency among estimators has been to recognize that there are a great many valid income concepts and that there are many possible combinations of national income data, each important to a certain concept or use. The "national income estimate" is thus being increasingly considered not as a summary general utility figure but rather a nucleus about which the income data pertinent to the operation of the national economy are gathered.

The Hungarian study under review is particularly valuable in that the authors have taken the latter approach and have presented fully the details of their underlying estimates. They have gone further and made available a great deal of pertinent data, such as are often unearthed in income studies but only incidentally used in the actual preparation of the estimates.

Five different totals of the national income of Hungary are presented: (1) net value of material goods produced valued at producers' prices; (2) net value of material goods produced valued at retail prices (arrived at by adding cost of transportation, distribution, and certain indirect taxes to No. 1 above); (3) so-called "total national income" (derived from No. 2 above by adding the estimated rental value of dwellings, the value of domestic work, and income from theatres and cinemas); (4) total of individual incomes (obtained by deducting from No. 3 above the indirect taxes and adding the value of services performed by civil servants and by certain professions such as physicians, lawyers, and teachers); and (5) total amount spent on living (item No. 3 above less the amount retained as capital goods and "adding, with inverse sign, the balance of foreign trade").

Throughout the work the net-value-of-product method of estimate has been used, that is, costs of materials have been deducted from the gross income of the various industries, leaving the total amounts consumed by individuals or saved. This precludes the breakdown of income by kind (salaries and wages, dividends, interest, etc). The income series are deflated for price changes by applying separate price indexes to the contribution of each industrial group, so that changes in physical volume of output, or real income, can be traced.

A distinct deviation from American practice is the exclusion of the incomes of independent physicians, lawyers, and civil servants from the "total national income" estimates, on the theory that the contributions of these individuals have already been included in the value of production assigned to other industries. Their function has been interpreted as auxiliary to the maintenance of a given volume of income, rather than as directly contributing to it. (But theatres and cinemas are considered as making a direct and independent contribution.) From the American standpoint, however, such vagaries of income theory are far outweighed by the practice of the authors

in reporting the component items in their estimates separately so that totals can be obtained which conform to the individual requirements of those using the data.

Following the early investigations of Professor de Fellner of the Hungarian national income, which they have greatly expanded both as to time and to coverage, the authors have made an important contribution to the growing international literature dealing with this subject.

Robert F. Martin

National Industrial Conference Board

The Problems of a Changing Population, Report of the Committee on Population Problems to the National Resources Committee. Washington, D. C. May, 1938, iv, 306 pp. 75 cents.

The National Resources Committee (Board), in a report issued in 1934 on National Planning and Public Works in Relation to Natural Resources, enunciated the fundamental principle that "the application of engineering and technical knowledge to the reorganization of the natural resources of the Nation is not an end in itself, but is to be conceived as a means of progressively decreasing the burdens imposed upon labor, raising the standard of living, and enhancing the well-being of the masses of the people."

Aware of the many investigations already made by experts in different fields concerning one or another aspect of the population problem in the United States and the accumulated materials available for interpretation, *the Committee sought to promote a widespread recognition and understanding of the many and related specific problems now emerging in this field which merit serious study. The results and implications of all inquiries, old and new, needed to be interpreted to a larger number of people in our democracy*, in order that action may be based upon knowledge and wisdom, and that the continued development of needed information and research may be encouraged.

Considering the various angles from which population problems may be viewed, and recognizing the joint interests of the natural, social, and educational sciences in the broad picture of population, the Resources Committee set up *a special population committee to supervise the preparation of this report.* The result is the most inclusive and useful summary of American population and related problems ever published, together with detailed factual materials in the form of statistical tables charts, and maps. The report was prepared by a carefully selected technical staff under the direction of Dr. Frank Lorimer, Secretary of the Population Association of America.

Sections of the work are devoted to trends in population growth and composition changes, with a limited discussion of their economic significance; regional distribution of economic opportunity; problems of internal migration; regional and racial differential fertility and natural increase; social conditions affecting birth rates and group differences in natural increase;

physical characteristics and biological inheritance; health and physical development; social development and education; and cultural diversity in American life. Relation of population studies to various governmental activities and major fields and basic data for research are discussed in Appendix A; a bibliography of government-sponsored population research is included in Appendix B; and a description of the continuous register system of population accounting in Belgium, Netherlands, and Sweden is added in Appendix C.

On some topics the evidence is relatively adequate and the implications are clear and decisive; on others, definitive conclusions are not yet possible because of meager information, deficiencies in sources, or need for further research. The reader of this report should refer to a volume published in the same year (1938), *Needed Population Research*, prepared by Dr. P. K. Whelpton, of the Scripps Foundation for Research in Population Problems, with the advice and cooperation of other leaders in this field. The study, sponsored by the Population Association of America, evaluates the adequacy of our present knowledge, points out gaps in our information, and suggests important problems requiring further research.

This investigation of the Resources Committee has explored far beyond the facts of population and vital statistics, to include within its scope the relation of population changes to physical welfare, education, and cultural life, and to analyze and interpret various conditions affecting the conservation and development of human resources. It emphasizes the importance of widening the opportunities for individuals in our population, and it dedicates our natural resources to the attainment for our people of a higher standard of living.

The report shows admirable restraint in stating the implications of the facts, avoiding alarmist interpretations. These might have seemed very plausible when the reader contemplates the rapidly increasing proportions at ages 45–64, where productive employment is most difficult at present, and the relatively large natural increases in certain rural areas where resources are quite inadequate to provide proper diet, medical care, and educational and recreational facilities. Much of the analysis is regional, disclosing disparities in the distribution of population and of natural, economic, and cultural resources, which emphasize problems of nationwide concern.

Facing the approaching situation of a stationary or even a declining population, the Committee calmly points out that this transition "may on the whole be beneficial to the life of the Nation. It insures the continuance of a favorable ratio of population to natural resources in the United States. . . . Changes in population trends must be taken realistically into account, and this is possible because of the gradual character of these changes and the time interval between birth and productivity."

Other reviewers have called attention to the abrupt and unsatisfactory ending of Chapter V on "Social Conditions Affecting Birth Rates," contributed by Dr. Clyde V. Kiser. (Frank W. Notestein, *Popluation Index*,

July, 1938, and J. J. Spengler, *American Economic Review*, December, 1938.) In the first printing, the concluding section of this chapter on "factors underlying group differences in fertility" had only two paragraphs and those were devoted to biological factors. Inquiry disclosed that the author's manuscript summarized the evidence indicating that biological factors are relatively unimportant, and that group differences in fertility arise largely through differences in the practice of contraception. This evidence is trustworthy and has an important bearing upon the future trends of group differences in fertility, yet it did not appear in the first printing of the volume. The excellent reception of the report has already required a second printing in which the misleading conclusion of this chapter has been corrected. On invitation by the Committee, Dr. Kiser has revised and extended the final page of his discussion to include as adequate a summary of the deleted material as space permits.

The report has an excellent table of contents, and the bibliography found in the extensive footnotes will prove invaluable to the student of population. But there is no listing of tables, charts, and maps by title and page for ready reference. The tables and charts are numbered in order within each of the nine chapters, starting anew in each chapter. In a reference work of this encyclopedic character, with so many tables, charts, and maps, they should be numbered in serial order for the entire volume. A complete list of each series, with titles and pages on which they are located, should accompany the table of contents.

Robert E. Chaddock

Columbia University

The Synthetic Optimum of Population, An Outline of an International Demographic Policy, by Imre Ferenczi. Paris: International Institute Of Intellectual Co-operation, League of Nations. International Studies Conference. 1938. 115 pp.

This little book contains 230 references to theoretical and statistical studies and 460 ideas. Optimum population for nations is defined with reference to "national economy, social policy, security, rational demographic evolution, and procreative selection according to the principles of eugenics," as a foundation for a "national and international synthesis giving due weight, not only to economic and social viewpoints and to considerations of national defence, but likewise to demographic and eugenic ideas and forecasts." The concept of the "realistic world optimum," which is admitted at present to be merely an ethical aspiration, "designates size of world population which occasions the smallest possible difference between the national social optima; dynamically, it implies the general tendency toward a maximum alignment of national standards of living and conditions of security." A few measures toward this end, proposed for immediate consider-

ation, include an international agreement on the statistical and other criteria of the synthetic optimum of population, an international convention concerning a uniform social policy relative to the distribution of family burdens, agreements on social principles related to a uniform qualitative population policy, and technical studies relating to these agreements—to be promoted by a mixed commission of the League of Nations and the International Labor Office. It is recognized that "peace treaties have never yet been drafted on the basis of this idea of a realistic optimum population;" but the author believes that "the utility of a thorough discussion of the complex problems concerning the synthetic optimum of population . . . ought to be recognized even by the most sceptical statesmen and by the most authoritarian governments." This theme is developed with many interesting notes on racial theories, autarchy, objective standards of nutrition, measurement of net reproductivity, and the futility of an armaments program as a means of relieving unemployment.

The more limited, technical treatment of optimum population theory presented by Ferenczi is open to certain criticisms. The economic analysis is essentially static; there is no systematic treatment of the economic effects of a change, as such, from population increase to stability or decrease, or vice versa. It is proposed that "economic density of population" be measured by income and level of living. The concept of economic density is thus broadened to that of economic welfare; and the specific significance of density of population as such is lost. A significant approach to the study of international variations in density of population might be afforded by estimates of the number of persons directly dependent on the exploitation of natural resources (farmers, foresters, fishers, miners, and their families) in relation to the potential net productivity of these resources under comparable conditions and in relation to total population. The author shows that estimates of this sort are now extremely fragmentary and unreliable. It would seem to the reviewer that much more attention might well be given to some of these relatively concrete aspects of the vast field which Ferenczi has so imaginatively surveyed.

FRANK LORIMER

The American University
Washington, D.C.

France Faces Depopulation, by Joseph J. Spengler. Durham, North Carolina: Duke University Press. 1938. xi, 313 pp. $3.00.

Dr. Spengler has crystallized into a compact volume the essential data portraying France's long-standing problem of depopulation, her efforts to cope with this problem, and a rationale for the failure of these efforts. As a result, he has produced a case history of value, not only to the academic world, but also to legislators and leaders of public opinion in all countries.

In the first chapter, the author presents evidence which indicates that France experienced fluctuations in the rate of population growth before 1800 and that there actually were then periods of decline in numbers. These fluctuations are attributed largely to variations in agricultural prosperity, in peace and war, and in the physical health of the population. Whereas population growth in France during the eighteenth century was largely by natural increase, since then immigration furnished the principal source for her increasing numbers. It is pointed out that, before 1815, urbanization of population in France was more rapid than in other European countries, but, following 1870, the pace was set by countries outside France. On the whole "population growth has been greatest in departments with elastic nonagricultural employments; least (i.e., negative) in agricultural departments. . . . "

French depopulation apparently had an early start and later had the assistance of man's ingenuity. Thus, after an examination into the natural increase of France from 1650 to 1935, the following conclusions, among others, are suggested " . . . a socio-psychological attitude favorable to birth control existed already in the early eighteenth century, if not prior to that time . . . " and "the decline (*in population*) is traceable immediately to the increased practice of birth control. . . . " As a result, it is found that in the present state of affairs, "French fertility must be increased if the French population is to maintain itself or increase"—a conclusion which may bear the name of many other countries.

In many respects, differentials in natality and fertility in regard to social and economic factors in France and in the United States follow the same pattern. Thus, fertility among foreigners, though higher than that among the natives, tends toward the level of the latter. Likewise, in both France and the United States, fertility is greater in rural than in urban areas. It remains to be established whether, in France, fertility is less where agriculture is commercialized than where it is self-sufficient, as observed by Taeuber in the United States. In regard to fertility by economic class, Dr. Spengler states that "although natality was inversely related to wealth in the nineteenth century, . . . the relationship may be positive today." Of particular interest is the author's observation that, in the present century, fertility in France is declining most among employees and laborers and least among proprietors. The author also notes a positive relationship between religious piety and fertility in France.

Alarm over depopulation was manifest in France even in the late fourteenth and fifteenth centuries, following the ravages of the Black Death and Hundred Years' War. Thereafter, little thought was given to population problems until the eighteenth century. In that century the mercantilistic view that the common man existed merely to serve the state gave way to the influence of the Physiocrats who stressed the right of the individual to the pursuit of his own happiness and self-improvement. This trend was unfavorable to population growth. However, an excess of deaths over births

in 1854–55 and the realization of the relatively declining demographic position of France focused attention on the problem of depopulation and led to a search for population-stimulating measures.

Of the various explanations of the decline in natality, that of Dumont attracted much attention and, in view of recent international politics, should be of special interest: "Political and legal democracy inspired men to struggle to rise in the socio-economic pyramid to which economic inequality had given birth and in the upper reaches of which the greatest happiness was to be found. The bulk of the population, therefore, not only strove to ascend politically, economically, socially, and intellectually, but also experienced an imperative urge to climb and a palsying fear of descent. Consequently, since children impeded individual and familial ascension, their number was limited." Dr. Spengler also describes, in some detail, the theory of Le Play, who emphasized the French inheritance law as a factor in voluntary family limitation, and of Leroy-Beaulieu, who centered his argument regarding decline in fertility about the rise of "civilization."

In contradistinction to other European countries, whose population policies were influenced by a seemingly surplus population at home, French colonial policy was predicated on the belief that "colonies might stimulate French natality, enable France to assimilate foreign peoples, and provide for France in non-European areas sources of economic and political strength not obtainable in the slowly growing mother country." Not all of these hopes have been realized.

For a long period before the war, immigration into France was unrestricted, in large degree, and regarded as a source for population growth. Postwar measures of control were designed to stimulate immigration, principally by treaties guaranteeing to immigrants practically the same privileges as available to French citizens. Recent unemployment, however, has given rise to opposition. Moreover, the fall in the birth rate in other lands and the present unsettled international situation are drying up the sources of immigration.

Following his detailed survey of the many measures taken to stimulate natural increase in France, Dr. Spengler concludes that these undertakings have failed "because they are founded upon inadequate conceptions of the cause of the decline in fertility" and in particular "because the pecuniary aids provide parents with but a fraction of the cost of rearing children." In the event that the government should be burdened with the entire cost of rearing children, "social pressure will develop both to limit such compensation and the right to reproduce to healthy and comparatively able families and to reorganize childbearing institutions in ways conducive to the reduction of the direct and alternative costs per child per year to a minimum." Even so the population may fail to rise. Then, "the actual task of bearing children may be turned over to selected women who perform this function under state auspices and in exchange for stipulated remuneration."

Lastly, Dr. Spengler presents an analysis (based on a closed economy)

from which he concludes that, with diminishing resources, an appreciable decline in French population may possibly elevate individual welfare for some time to come. This conclusion may be compatible with the concept of the optimum population for a democracy. But, in other than a closed economy, a nation may be faced with problems created by neighbors whose concept of an optimum population possibly is built around militant ideals.

Mortimer Spiegelman

Statistical Bureau
Metropolitan Life Insurance Company

Racial Origins and Nativity of the Canadian People, by W. Burton Hurd. Ottawa, Canada: Dominion Bureau of Statistics. Census Monograph No. 4. Reprinted from Vol. XII, Seventh Census of Canada, 1931. 1937. xvii, 292 pp. 35 cents.

In the Canadian census the entire population is classified by racial origin. In this classification the nonwhite races (Negro, Indian, Chinese, etc.) each constitute a single class, but the whites are subdivided into 20-odd groups, for the most part on the basis of the European country from which their ancestors originally came. The census monograph under consideration is a study of the classification by racial origin in combination with other census classifications and with certain significant data obtained from non-census sources. The census classifications include nativity, mother tongue, naturalization, and date of arrival in Canada for the foreign born, sex, age, marital status, residence (whether urban or rural), ability to speak either of the official languages of Canada (English or French), illiteracy, school attendance, occupation, and religion. The items obtained from sources outside the population census include intermarriage (that is, the marriage of persons of different racial origins), crime, fertility, infant mortality, and certain physical and mental defects.

The main points brought out by these various combinations of classifications are summarized in the first few pages of the monograph. Each topic is then developed at greater length in a chapter which not only discusses the classifications and their interrelations, but also gives historical background as needed and shows the relation between the data under discussion and the economic and social development of the country. Charts, consisting for the most part of bar diagrams of various types, are freely and effectively used. In connection with a number of subjects, correlation indexes have been worked out, indicating the extent of the relation between the main topic and various subsidiary topics which might be assumed to have an influence on it.

In the classification by nativity, the Canadian born are first separated from the foreign born, and the foreign born of each racial origin are then classified by country of birth. One interesting point brought out by this

tabulation is that considerable fractions of some of the European stocks in the Canadian population—particularly the German and Scandinavian—were born in the United States. The classification by mother tongue in combination with racial origin affords an interesting measure of the progress of assimilation. A considerable percentage of most of the older racial groups in the Canadian population, particularly those rather largely Canadian born, report English as mother tongue. Of the population of German racial origin, for example, of whom only 8 per cent were born in Germany, nearly 43 per cent reported English as mother tongue, while of the Finns, of whom about 75 per cent were born in Finland, less than 5 per cent reported English as mother tongue.

Some of the noncensus data seem to have a somewhat less secure foundation than the census classifications. The data on intermarriage, for example, are based on the birth certificates for children born either during the year 1931 or during the three-year period 1930 to 1932. The birth certificate gives the racial origin of both parents, and it is assumed that the distribution of mixed marriages in the population is the same as the distribution of the parents of children born during this period. One might object to this assumption on three points: First, that childless marriages cannot possibly be represented in these statistics; second, that those racial groups or combinations which are more fertile are overrepresented, and those which are less fertile are underrepresented; and, third, that racial groups of long standing, having several generations in Canada, will be differently represented than those made up mainly of recent arrivals. In view of the extent to which these three factors may affect the figures obtained from the birth certificates, it would seem that more emphatic qualifications of the intermarriage data should have been made. As the work stands, a noncritical reader is likely to get the idea that the figures represent actually recorded statistics of marriages. One feels, likewise, that some of the other noncensus items—the figures used as an index of criminality, for example, or even the infant mortality rates (note on page 281 the rate of 16.7 per 1,000 for the Bulgarian stock)—are appreciably less adequate than those which are obtained from the population census itself, either because of the narrow range of the basic data or of difficulty in fitting them to the racial origin classification.

LEON E. TRUESDELL

Bureau of the Census
U. S. Department of Commerce

Natural Increase and Migration, Greater Cleveland, 1919–1937, by Howard Whipple Green. Cleveland: Cleveland Health Council. 1938. 75 pp. $1.00.

Howard Whipple Green prepared the census tract map of Cleveland for the Bureau of the Census in 1927, and, since that time, in his capacity of Secretary of the Cleveland Health Council, he has continued his studies of

the internal distribution and movements of the population. The present multilithed volume, abundantly illustrated with maps and graphs, deals with natural increase and internal migration by census tracts. The familiar vital-statistics method of calculating migration has been used; that is, from the total increase of population between census periods, the excess of births over deaths has been subtracted. A positive remainder indicates a migration gain, a negative remainder a migration loss.

The census tracts have been grouped into 10 economic classes to which natural increase and migration were related. The census tracts in the lower three deciles were areas of migration loss and actual population decrease as well, whereas those in the upper seven deciles were areas of migration gain and population increase. In general, the higher the economic level, the greater was the gain in population by migration. Of course, there is a close relation between the economic level of an area and the stage of cultural succession. The low economic groups are near the commercial core and have passed through most of the stages of deterioration from residential to commercial use. On the other hand, the highest economic groups are new residential subdivisions. Thus immigration into the highest economic areas and emigration out of the lowest would be expected.

C. W. Thornthwaite

Soil Conservation Service
U. S. Department of Agriculture

Joint Committee on Mortality, Occupational Study (1937). New York: Compiled and Published by the Actuarial Society of America and the Association of Life Insurance Medical Directors. 1938. 95 pp.

This book is essentially a supplement to the *Joint Occupation Study (1928)* and gives mortality statistics for certain occupational classes for which the results in the earlier report were considered inconclusive or in which conditions were believed to have changed. The study dealt with the policy issues of the years 1925–35 and was contributed to by 13 of the largest life insurance companies. The occupations included are an assorted group, and no particular type of occupation predominates. In addition to the detailed tables, valuable summaries are given, particular attention being called to those classes where a considerable difference was found between the premium ratings imposed by the companies and the mortality actually experienced. Mortality was high among underground miners, stone cutters, metal chippers, and motorcycle policemen. As in the previous report, the probable error of the ratio of actual to expected deaths is given for each class, in order that the results in the smaller groups may be properly evaluated.

Thomas N. E. Greville

University of Michigan

Member-Bank Borrowing, by Robert C. Turner. Columbus, Ohio: The Ohio State University. December, 1938. xiv, 243 pp.

This study of the period January, 1922, to October, 1936, deals with the problem facing member banks when deficits in reserves occur. Under what circumstances will they borrow at the reserve banks to increase reserve balances rather than dispose of assets? The author believes that Dr. Riefler's need theory of borrowing is not a complete explanation and should be supplemented by a profit theory of borrowing. He contends that the tradition against borrowing is neither as powerful nor as unvarying a deterrent as is generally believed. If need is broadly interpreted to mean that banks borrow to replace reserves, then all borrowing is for need. But profit motives may be a factor.

The author reasons that, when deficits in reserves arise, banks tend to borrow if open-market rates are high relative to discount rates and to sell open-market paper if the reverse is true. The proposition is tested graphically by comparing the volume of borrowing with the "profit spread" (difference between average discount rate and average open-market paper rate). Linear coefficients of correlation are computed and leads in the profit spread introduced to test the effect upon the coefficient. There is, in general, a good parallelism between the discounts and profit spread curves for the years 1923 to 1930, inclusive. The coefficient of correlation is 0.867. There is some indication that the profit spread tends to lead. For the period January, 1930, to October, 1936, when the profit spread was generally negative, the coefficient of correlation is 0.468. The question might be raised why there should be any close similarity between the curves under such conditions. It would seem that the tendency should be for discounts to decline towards zero, with the result that fluctuations in the negative profit spread would have little similarity to the discount curve.

The results for the separate Federal Reserve districts are mixed. For the period 1923 to 1930, inclusive, the Boston, Cleveland, Philadelphia, Chicago, New York, and San Francisco districts, in the order named, have the highest coefficients of correlation, but the figures for the Richmond, Minneapolis, and Dallas districts are low. In general, the coefficient figures for the period 1930 to 1936 are low. In a number of districts the cyclical movement resulted in a higher figure for the period 1922 to 1936 than for any of the shorter periods. Hence the former figures are somewhat misleading.

Since Dr. Riefler admits that when member banks borrow they may be affected to a certain extent by the cost of such borrowing in relation to money rates and the author interprets borrowing for profit to mean choosing the less costly way of replenishing reserves, there is less fundamental difference between the two positions than may at first appear. Nevertheless the author has performed a real service in showing the sphere and scope of the profit motive in borrowing. Some repetition in presentation might have been avoided.

ERNEST A. JOHNSON

Lake Forest College

Les opérations des banques d'émission sur le marché libre (Open market policy), by Miroslav Kříž. Paris: Receuil Sirey. 1938. 282 pp. 35 fr.

This volume provides a useful survey of open-market operations as they are carried on by the central banks of 15 countries. The development of this instrument of central-bank policy is traced from the early part of the ninteenth century, when the Bank of England rather hesitantly entered the market for Government securities and acceptances in order to re-enforce changes in the discount rate, down to the postwar period in which open market operations have been viewed as a means of credit control in their own right.

The change has come about largely as a result of the abandonment of the gold standard in many countries. Before the war, when gold flows reacted quickly upon internal monetary conditions, they tended to be self-limiting. Under such circumstances, the discount rate was raised when gold was being exported, in order to increase the deflationary effect of the exports and reverse the direction of the gold movement. At the present time, when gold flows often do not react upon the domestic credit structure in such a way as to check themselves, central banks have in many cases directed their policies toward the counteracting of gold flows. For this purpose they have found open-market operations especially effective.

The author quotes with apparent approval such authorities as Keynes and Hawtrey who are optimistic about the use of open-market operations during a depression as a means of restoring prosperity. He treats in some detail the experience of the United States in this regard and is obliged to admit that the hoped-for results were not obtained, but this does not alter his somewhat uncritical enthusiasm for open-market operations as a remedy for depression. This part of the study might have been profitably enlarged to include actual results of open-market operations in different countries and to bridge the gap between the optimism of the theorists and the pessimism of the practitioners. It would have been interesting to the American reader had more of the reasons been given for the belated French recognition of open-market operations. In that country there was for many years strong opposition—on the part of the Bank of France as well as of Treasury officials and others—to the granting of such powers to the central bank.

The close similarity between many of the operations now carried on by treasuries, through their stabilization and equalization funds, and the open-market operations of central banks is pointed out. The author is not averse to this type of action by treasuries but would have them recognized for what they are, forms of credit control.

One of the most useful features of the book is a summary of the legal limitations upon open-market operations in each of the countries in which they are authorized, with regard to type of security and total amount of operations. The book is well indexed.

Margaret G. Myers

Vassar College

Control Policies of the Reichsbank, 1924–1933, by Mildred B. Northrop. New York: Columbia University Press. London: P. S. King & Son, Ltd. Studies in History, Economics and Public Law, Edited by the Faculty of Political Science of Columbia University, Number 436. 1938. 405 pp. $4.00.

The purpose of this study is to explain the monetary policies and control techniques of the Reichsbank, 1924–33. Part I describes the background of central bank control in Germany, including historical development of the Reichsbank, nature of the commercial banking system, money market, and role played by the Reichsbank in Germany's economic development. Emphasis is placed on postwar modifications in the Bank's constitution, particularly those which denied to the Reichsbank the right of engaging in open-market operations. Charter limitations, however, were largely overcome through the instrumentality of the Rentenbank and the Gold Discount Bank. With the help of these subsidiaries the Reichsbank was able to supply export credits, get control of public funds, aid agriculture, and engage in open-market operations.

Dr. Northrop enumerates three changes which occurred in Germany's commercial banking system during the decade 1924–33. These were: "(1) the entrance of all types of banks into the commercial credit field and the resulting expansion of short-term credit; (2) the rapid integration and centralization which took place in each of the bank groups; and (3) the growth of public credit institutions." All three developments strengthened the power of the Reichsbank over monetary and credit conditions. Far-reaching changes occurred also in the money market. The inflow of short-term foreign funds meant that the Bank's power to control the money market was shifted from its discount policy to its foreign exchange policy.

Part II deals with control objectives and techniques. While the Reichsbank's aim, broadly conceived, was to promote the economic welfare of Germany, the author describes seven specific objectives. The most important of these were: (1) to maintain currency stability in terms of the foreign exchanges; (2) to maintain the stability of the domestic price level; and (3) to direct domestic and foreign capital to "productive" ends. To accomplish these and other purposes the Bank used control techniques as follows: manipulation of the discount rate, lowering of the buying price of gold, credit restriction, bargaining, warnings, and publicity. The first two are traditional weapons and, generally speaking, were used successfully by the Reichsbank. In cases where the orthodox methods failed, as for example in April, 1924, the more drastic expedient of credit restriction was utilized. The resorting to this powerful weapon, though subjecting the German economy to severe shocks, enabled the Bank to gain its ends, except in 1931 when gold and foreign exchange were being withdrawn in large amounts. The author concludes that "credit restriction and credit rationing seem to be devices full of potential power to a central bank that conceives its task to be 'control for a public purpose'."

In the concluding chapter, Dr. Northrop briefly contrasts the prewar

situation with the conditions under which the Reichsbank was forced to operate, 1924–33. In the former period, national and international money and credit interests were identical; in the latter, they diverge. This shift from an international to a national viewpoint largely accounts for the Reichsbank's break with the orthodox aims and methods of central banks. The Banks accomplished much for Germany. If it failed to solve many problems the reason may well be that "monetary management is not the sole answer to the wider problem of economic stabilization."

Dr. Northrop has given a sane interpretation of the Reichsbank's control policies during the period under consideration. For economists and others interested in securing a remarkably clear and readable account of Germany's monetary and banking experience from the financial reorganization of the early twenties to the advent of Adolph Hitler, this book is to be highly recommended.

M. K. Inman

University of Western Ontario

Economic Consequences of Recent American Tax Policy, by Gerhard Colm and Fritz Lehmann. New York: The Graduate Faculty of Political and Social Science, New School for Social Research. 1938. xii, 108 pp. $1.00.

Professors Colm and Lehmann have written a monograph which has the beauty of geometry. With amazing brevity, they have packed into about 80 pages a brilliant analysis of recent Federal tax policy. One almost feels that they have been guilty themselves of oversaving, in words if not in ideas.

In the long run, according to their analysis, annual savings ($11–$12 billion on a national income of $80 billion) exceed the annual demand for capital (about $8 billion). This will not be corrected appreciably by either lower interest rates or a rising standard of living. In the short run, there can be either scarcity or oversupply of capital.

The new tax laws (1932–36) affect savings as follows:

		(in millions of dollars)
Reduction in Savings:	Personal Income, Estate & Gift	1,100–1,400
	Capital Gains	...
	Undistributed Profits	840
		1,940–2,240
Increase in Savings:	Social Security Reserve	1,000
	Additional Debt Redemption	500
	Savings of Recipients of Government Disbursements	100
		1,600

The net effect of taxation in correcting oversaving is therefore not great.

The new taxes, by shifting savings down the income pyramid and by discouraging capital gains, tend to reduce the supply of equity or venturesome capital. This is particularly important in connection with short-run fluctuations, for venturesome capital is needed most to sustain a recovery movement in its more advanced stages.

The authors tersely suggest alternative methods for dealing with the conditions outlined above. The long-run tendency towards over-saving could be corrected by revising the tax structure to discourage savings further, by increased absorption by government, and, less effectively, by easy money, by capital exports, or by a reduction in the individual inclination toward thrift. Lack of equity capital might be offset by increased use of loans (questionable), by increased willingness to buy stocks(perhaps through investment trusts), by tax revision, by abolition of tax-exempt securities, by reduced margin requirements, by modified SEC regulation, or by new methods of financing small enterprises. The need for short-run adjustment suggests a tax policy which would provide for tax exemption during short periods when equity capital is particularly needed, or through fiscal and monetary controls affecting capital demand.

It should be noted that this analysis was made while the Undistributed Profits Tax was still on the statute books in its original form. The authors regard this highly debated tax as a significant factor in reducing national savings. If this tax is dropped from their calculations, the over-all effect of the tax laws analyzed is not a net reduction but an actual increase in the volume of savings. Their concern about oversaving is thus made even more cogent.

The analysis is directed primarily at taxation and the capital markets. One of the significant developments of recent years, however, has been the increased burden of taxes on consumption. Sales taxes and payroll taxes have become of tremendous importance. Their short-run effect as depressants has been clearly demonstrated. It is to be hoped that some day Professors Colm and Lehmann will turn their talents to analyzing this side of the tax picture.

WILLARD L. THORP

Dun & Bradstreet, Inc.

Realty Tax Delinquency in Michigan, by Robert S. Ford. Ann Arbor: University of Michigan. Bureau of Government, New Series Bulletin No. 8. October, 1937. vi, 125 pp. $1.00.

This monograph is based on an immense amount of statistical data and concerns a state which has had a particularly acute property tax delinquency problem. Two facts facilitated the study: (1) tax delinquency records in Michigan are centralized in the office of the auditor general who is re-

sponsible for the collection of delinquent real property taxes, except in six cities; and (2) funds were granted for a W.P.A. project to assist in compiling the statistical data. No tax sales were conducted after 1932 until 1938, and various modifications were made in the law with respect to the collection of taxes. This study was undertaken to determine the amount and nature of tax delinquency and to measure the success of the Moore-Holbeck act of 1933 which permitted taxes delinquent for 1932 and prior years to be paid in installments over a 10-year period beginning in September, 1935. First, the net delinquency existing in the last quarter of 1935 for taxes levied in 1932 and prior years was computed for each county and shown separately for rural and urban areas. The degree of delinquency was found to range in 82 counties from 4.4 per cent of the 1932 tax levy in Kalamazoo to 71 per cent in Oakland, a county in the Detroit metropolitan area.

Although widely hailed as the salvation of the property owner, the Moore-Holbeck installment payment plan has been utilized by only a small proportion of the tax delinquent owners. On September 1, 1935, when the opportunity to secure the advantages of the plan expired, 77 per cent of the parcels were still delinquent for taxes levied in 1932 and prior years. Of the remainder, the taxes had been paid up on 10.2 per cent of the parcels, and only 12.8 per cent of the delinquent parcels had been placed under the partial payment plan. The latter, however, accounted for 23 per cent of the total amount of the delinquency. A frequency distribution showed that 50 per cent of the delinquencies amounted to $50 or less and 80 per cent to less than $150.

A sample of 13 counties was used for a comparison of long- and short-term net delinquency. Long-term delinquency applied to 1929 and prior years, and short-term delinquency to the period 1930–34, inclusive. The ratio of long- to short-term delinquency ranged from 3.8 to 95 per cent. In some instances, taxes levied more than 40 years earlier were being carried on the books. The length of the period of delinquency, however, was five years or less for 77 per cent of the parcels, and these represented 74 per cent of the total net delinquency.

Before 1930, most of the delinquent land bid off by the state was located in cut-over sections of northern Michigan that have proven unsuitable for agriculture. During the depression, although the amount of taxes delinquent in this area mounted, the greater proportion of the delinquency in the state was concentrated in urban sections, particularly in the Detroit metropolitan area. This section had been subject to excessive real estate subdivision and speculative promotion in the previous decade.

Michigan thus has two quite different delinquency problems. Tax-delinquent lands in the northern part of the state are rapidly being added to the public domain and administered as forest lands by the Department of Conservation. In southern Michigan, however, the problem is to keep the land in private ownership and on the tax rolls. A state land office board has been created which is to conduct a "salvage tax sale" of delinquent lands in

this area in 1940, at which the property may be sold at not less than 25 per cent of its 1939 assessed valuation.

The author gives an excellent summary of the causes of tax delinquency and the proposals for minimizing it. He points to the need for more adequate statistics of tax delinquency, criticizes certain features of the new legislation relating to tax collection, and indicates that not enough attention has been directed toward improved property tax administration and prevention of future tax delinquency.

DENZEL C. CLINE

Michigan State College

World Finance 1937–1938, by Paul Einzig. New York: The Macmillan Co. 1938. xvii, 336 pp. $3.00.

Paul Einzig is one of our most prolific writers on world monetary and financial problems. His position on the *London Financial News* gives him an opportunity to discover facts and currents of thought unknown to the average academic economist. He writes in an easy-flowing, brilliant journalistic style.

His belief that monetary mismanagement is responsible for many of the ills of the world during the past 20 years is well known. The civil war in Spain, Mussolini's Ethiopian adventure, and even the rise of Hitler are ascribed in large part to unsound monetary policies. He is not one of those who believes that the totalitarian states are headed for an early economic collapse. The reviewer agrees that on this point Einzig is probably right. Dictators can hold an economic structure together under conditions that would wreck a democracy.

The pattern of this volume largely follows that of his earlier two books on World Finanace. As usual, he spends much time describing and analyzing the mistakes of French financial policy, for example, the refusal to devalue the franc when devaluation was essential. It is his belief that the attempt to save the *franc* made it almost impossible to save *France*.

Much of the present study has to do with the monetary policies of President Roosevelt. Americans will be particularly interested in Chapter XXVIII on "President Roosevelt's Dilemma." The gold scare early in 1937, due to the fear that Roosevelt would reduce the price of gold, was largely responsible for the collapse in that year. Einzig admits that he had expected no such decline. Would that more economists would so openly admit that they were wrong in their forecasts!

His comment on President Roosevelt is illuminating (pages 211–12): "Thus while originally the theory that the business recession was due to President Roosevelt's anti-capitalist measures was not true, it subsequently became only too true. As the author of *Alice in Wonderland* remarked in *The Hunting of the Snark*, if a thing is said three times it becomes true. By

the middle of the autumn everybody was convinced that nothing short of a drastic revision of President Roosevelt's anticapitalist legislation could possible turn the tide. And since everybody was convinced that this was so, it was well on its way towards becoming true.

"There could be no doubt that President Roosevelt held the key to the situation. Ever since his advent to office in 1933 he had occupied an outstanding position among the statesmen capable of influencing the economic destinies of the world. It was his ruthless reflationary policy that turned the tide. It was largely his departure from his reflationary principles that brought about the gold scare which reversed the tide. Official quarters, bankers, newspapers, investors and speculators over the five continents have become accustomed to look towards Washington, hoping or fearing—as the case may be—that President Roosevelt may take some action. A casual remark by him is sufficient to turn the tide of the exchanges, of gold and silver, of stocks and shares, or of commodities. His power for good and evil has been amply evident during the past five years. Never, however, had it been quite so evident as it was during the autumn of 1937."

Charles S. Tippetts

University of Pittsburgh

Die deutsche Wirtschaftslage von 1914 bis 1923, Krieg, Geldblähe und Wechsellagen, by Freidrich Hesse. Jena, Germany: Verlag von Gustav Fischer. "Beiträge zur Erforschung der wirtschaftlichen Wechsellagen Aufschwung, Krise, Stockung." Herausgegeben von Arthur Spiethoff, Heft 16, 1938. x, 498 pp. R.M. 15.–.

Dr. Hesse belongs in the "old school" of German descriptive economists who believe in presenting facts for the facts' sake. His voluminous study of German business cycles in such an extremely critical period as the war and the postwar inflation is, for the most part, an orderly grouping of data without any major attempt at either theoretical or statistical analysis. He is interested in such factual questions as what happened in the monetary system and public finance, in foreign trade, in building, and in individual industries during the five periods into which he breaks his detached presentation of facts. The attempt to "evalue" the facts by asking for the factors at play in each of the major periods does not amount to more than vague generalizations or a condensation of factual material. Most of the intricate problems of monetary theory, policy, and sociology raised by an inflation of astronomic dimensions, some of which have found extensive discussion in studies like those of F. D. Graham and Bresciani-Turoni, are scarcely mentioned. Of the German literature, all economists in disfavor with the Nazi regime are conspicuous by their absence even in the bibliography. The best part of the book is the statistical appendix of some 70 pages which compiles the available data of economic statistics of the period under dis-

cussion in a careful manner but without any attempt to utilize or even to evalue them from the point of view of their fitness for economic analysis.

MELCHIOR PALYI

University of Chicago

Fascist Economic Policy, An Analysis of Italy's Economic Experiment, by William G. Welk. Cambridge: Harvard University Press. Harvard Economic Studies, Volume LXII. 1938. xx, 365 pp. $4.00.

A comprehensive book on Italian fascism and its economic policy is very welcome at this moment. Some time has passed since the last fairly satisfactory studies on this ever-moving and changing subject have been published.

Some of the expectations with which one opens a book of this title are well satisfied, while others are not. The author has brought the institutional side of fascism's economic policy, particularly that of the corporative order, up to date and has added valuable material. His judgment about the real importance and function of the "corporazioni" seems essentially correct.

As to economic policy proper, the author is in general satisfied to outline the recent factual developments in agriculture, industry, banking, public finance, labor, and social politics, adding value to his narrative by statistics, some of which, however, might have gained in meaning and usefulness to Anglo-Saxons by reduction from the shifting current lire to the gold lire, or even by reduction to dollars. Appendices contain a digest of important fascist legislation, some further statistics, and a bibliography.

While the author undoubtedly has been facing extraordinary difficulties in making his account of recent events more complete, it would seem that more could have been done. The analysis of the financial situation fails to put the importance of the "enti parastatali" in proper relief, while the rather meager account of the agricultural developments does not follow up the recent evolution of the important problem which Voechting, among others, has discussed in a German-Italian symposium edited by Dobbert. A critical analysis of fascist price policies, like that recently attempted by Henry S. Miller in his book on *Price Control in Fascist Italy*, has not been given. It may be that such an effort did not enter the purpose of the author. In this case, however, it seems to us that he has exposed himself unnecessarily to criticism by the title he has chosen. Without a full discussion of the problems and the considerations and principles underlying the currency and credit policies, price policies, production policies, and labor policies of fascism, a discussion in the light of economic theory as well as of governmental theory, the chosen book title seems to promise more than the author fulfills and to work against the appreciation of the usefulness of the brief factual survey he actually gives.

HERBERT VON BECKERATH

Duke University

Balances of Payments, 1937. Geneva: League of Nations, Economic Intelligence Service. New York: Columbia University Press. 1938. 212 pp.

In addition to the presentation of national balance of payments statistics, in its usual complete fashion, this 1937 annual of the League of Nations contains a stimulating discussion of developments in international economic relations. Of general interest are the comments upon the recent development of debtor and creditor balances of payments; of particular interest to American economists is the note on the inflow of capital to the United States.

From 1927 through 1930 the current accounts of six creditor countries (United States, United Kingdom, France, Netherlands, Ireland, and Sweden) showed a heavy surplus ranging between £106,000,000 and £304,000,000. With the crisis of 1931 and the ensuing heavy liquidation of capital, a deficit resulted for 1931 and 1932, followed by small net surpluses up to 1935, and again by deficits in 1936 and 1937. The League of Nations indicates that this change, together with accelerated gold production and Eastern dishoarding, has enabled debtor countries to liquidate a considerable amount of foreign debt since 1931. In the opinion of the reviewer, these developments contain the possibility that the period of large-scale foreign lending is over and that, instead of capital flowing from creditor to debtor in periods of prosperity, high levels of industrial activity in creditor countries henceforward will involve import surpluses for creditors and hence perhaps capital repayment by debtors. This might well mean that business-cycle fluctuations in debtor countries would become less intense than those in creditor countries. The trend is especially clear in Canada, which has now been a capital exporter for six years.

With respect to the flow of capital to this country from 1935 through mid-1938, the League of Nations states that the foreign demand for American stocks markedly affected security price fluctuations here (Undersecretary of the Treasury John W. Hanes, calls this a "fallacy"—*New York Times*, March 4, 1939, page 21); that the proportion of transactions for foreign account on stock exchanges here reached 15 per cent in 1935, 20 per cent in 1936 and 1937 and 17 per cent in the first half of 1938 (contrast Mr. Hanes' "less than 1 per cent"); and that foreign security buying is highly speculative in character and recently for a remarkably short period. The 1935–37 wave of foreign buying of American securities exploded one myth—that Europeans were more astute investors than Americans—since on balance those investors bought at the top of the market. The problem of what the full effects of these purchases were on the American economy remains unsolved. It deserves a thorough investigation.

The League of Nations' now indispensable secondary-source books very nearly approach the statistician's ideal in presenting the full qualifications with which the material should be regarded. An objection may be registered, however, to the practice of presenting the synoptical tables in "old" gold dollars. The distortion of the data occasioned by this device, which serves no useful purpose, is most annoying.

Charles P. Kindleberger

New York City

The Sugar Economy of Puerto Rico, by Arthur D. Gayer, Paul T. Homan, and Earle K. James. New York: Columbia University Press. 1938. xviii, 326 pp. $3.75.

This study was undertaken at the request of two land-owning partnerships in Puerto Rico engaged in the cultivation of sugar cane and financed principally by capital coming from the continental United States. These firms, which probably are closely affiliated with two of the four large American sugar-producing concerns on the Island, invited the authors—two noted economists and an authority on Latin-American affairs—(1) to make an objective factual analysis of the Puerto Rican sugar industry and its relation to the general economy of the Island, and (2) to interpret their findings in relation to controversial questions of public policy affecting the sugar industry.

Of the two tasks—factual analysis and interpretation—the first, while by far the easier, seems to have proved infinitely more difficult than had been anticipated. In spite of the work of a survey staff of The Brookings Institution of which Dr. Victor S. Clark was the head and the reviewer a member (published in 1930 as *Porto Rico and its Problems*) and in spite of several studies sponsored by public agencies, the authors met woeful lack of factual data, which rendered well-nigh impossible the task of interpretation. Only if these difficulties are clearly kept in mind, and if it is remembered that the Puerto Rican problem is one of the most delicate and intricate situations challenging American statesmanship, can justice be done to this volume under review.

Under these circumstances the almost constant complaints of inadequacy of data and inability to pass judgment on controversial issues are not surprising. A number of chapters, especially the five chapters making up Part I on the Puerto Rican Economy as well as a few of the 12 chapters constituting Part II devoted to the sugar industry itself, are definitely descriptive or statistical and hence free from this feature. The remainder of the book—the chapters on Production Cost, Capital Investments and Earnings, Wages and Earnings, Supplemental Incomes, Sugar's Contribution to Insular Revenues, The Lafayette Project (a co-operative rehabilitation plan of the Puerto Rican Reconstruction Administration), and especially the three chapters which make up Part III embodying the authors' conclusions—is uniformly afflicted with the same sad refrain.

While such a state of affairs is deeply regrettable, it is to the authors' credit to have exercised such extreme caution and, by doing so, to have demonstrated in this instance that what to the uninformed might appear as sterility of economics is due neither to faulty methodology nor to personal inaptitude but to conditions beyond the economists' control—*force majeur* as it were. While much of the book therefore is negative in nature, it is nevertheless extremely valuable as an interim report and, as such, will indirectly contribute to the clarification of controversial issues.

Nor is the book wholly void of definite conclusions. Thus its authors whole-

heartedly concur in the general conclusion reached in the sugar section of Brookings Report (Appendix E), namely, that cane growing is that form of land utilization which *under present conditions* yields the highest net return to the island and that curtailment of cane acreage in favor of subsistence farming constitutes the surest way to aggravate rather than to alleviate the difficulties of Puerto Rican economy. In that connection, comments on the social and economic significance of the Federal restriction policy which resulted in a material reduction of Puerto Rican sugar output from its 1934 all-time high of 1.1 million tons would have been welcome.

It would be easy for the reviewer to enumerate other phases of the Puerto Rican sugar situation which he would like to have seen treated. Thus a full and frank discussion of the fact that the Puerto Rican sugar industry is a tariff-fostered, hot-house product subsidized by the American sugar-consuming public might be useful as a corollary to working out a sound public policy. Similarly, a study of the extent to which sugar mills enjoy the benefits of limited territorial monopoly in the purchase of colono cane—a topic occasionally touched upon (see pages 277, 288, 293, and 299) but never exhaustively treated—should contribute to such a formulation of policy. The absence in Puerto Rico of a refining industry comparable to that recently developed in other tropical regions, as well as the anomalous position of the South Porto Rican Sugar Company as a processor of Dominican cane at Guánica, P. R., might prove worth-while topics for further study. These and many other questions come to mind. Some perhaps were left untouched because the authors felt that New Deal legislation had provided at least tentative answers. Others undoubtedly were omitted for good reasons. And "fools rush in where angels fear to tread."

Erich W. Zimmermann

University of North Carolina

Wheat Studies of the Food Research Institute, Stanford University, California.

"World Wheat Survey and Outlook September 1938," by Helen C. Farnsworth and Holbrook Working. Volume XV, Number 1. September, 1938. Pp. 1–47. 75 cents.

"Shipping and Freight Rates in the Overseas Grain Trade," by V. D. Wickizer. Volume XV, Number 2. October, 1938. Pp. 49–210. $1.00.

"Wheat Futures Prices and Trading at Liverpool since 1886," by Holbrook Working and Sidney Hoos. Volume XV, Number 3. November, 1938. Pp. 121–80. $1.00.

"The World Wheat Situation, 1937–38, A Review of the Crop Year," by Joseph S. Davis. Volume XV, Number 4. December, 1938. Pp. 181–257. $1.25.

These four issues of Wheat Studies include a survey and outlook number, the annual review of the crop year, and two special studies. The survey and

outlook numbers appear three times each year and with the annual review constitute both a current appraisal and a continuing record of supplies, prices, international trade, and consumption of wheat. They are probably read most carefully by the professional students of commodity prices; less carefully by some of the more studious members of the grain trade; and hardly at all by economists who are not specializing in the field of agricultural prices. A partial explanation may be that the audience for which they are written is apparently composed largely of professional students of commodity prices. For persons without this specialized interest, most issues of Wheat Studies are heavy reading. The publication would rightly be classed as "strictly nonfiction" on any librarian's list.

It is unfortunate that, in the flood of printed matter with which they struggle, economists do not have more time for Wheat Studies, for in them are found facts about the life of the market about which many of us are still largely innocent. One such fact, most strikingly demonstrated in the issues dealing with the wheat situation in 1937 and 1938 is the nonhomogeneous nature of wheat. In April, 1938, No. 1 Manitoba sold in Winnipeg at nearly 70 cents per bushel above No. 6 Manitoba and about 65 cents per bushel above No. 2 Amber Durum. An attempt to explain these differences would be a good exercise both for the abstract economist interested in the principle of substitution and for the empiricist who is carefully drawing demand curves for wheat.

Other little-understood matters on which information can be gathered in these issues are the spreads between the prices of the similar qualities of wheat to be delivered at different times in the future, the relation of ocean freight rates to wheat prices and movement, and the myriad of governmental controls, restrictions, and subsidies that exporting and importing countries have adopted in the past few years. A good parlor game for economists is to see which can be the first to name a country in which there are no import quotas or duties, no export subsidies or controls, no subventions to growers, and no restrictions on the consumption of wheat.

The monograph on shipping and its relation to the grain trade deals with the varied relations of shipping services and organization, freight rates, and overseas movement of grain in a clear and informative manner. The difficult tasks of assembling, analyzing, and presenting the statistics on shipping and ocean freight rates have been successfully accomplished.

The special study on futures prices and trading at Liverpool since 1886 presents a valuable collection of average futures prices at Liverpool, including monthly and weekly averages and weekly spreads. The discussion of futures price series and of practices on that market is discriminating and presents material not previously available.

BLAIR STEWART

Commodity Exchange Administration
U. S. Department of Agriculture

Your Community, Its Provision for Health, Education, Safety, and Welfare, by Joanna C. Colcord. New York: Russell Sage Foundation. 1939. 249 pp. 85 cents.

The function of this book is to guide those interested in gathering facts about their own communities for the purpose of improving local living conditions. As a successor to the pamphlet, *What Social Workers Should Know About Their Own Communities*, by Margaret F. Byington, it is more comprehensive and includes the many changes in community organization which have occurred during the past nine years. Further, it is addressed to a much wider public which includes lay study groups, classes in the social sciences in high schools and colleges, and students in training for social work.

In addition to the subjects indicated in the subtitle, it deals with the following aspects of community life: setting, history, and government; workers, wages, and employment; housing, zoning, and city planning; minorities, religious agencies, and various clubs and associations; provisions for the handicapped, delinquents, public assistance, family and child welfare, and recreation; and agencies for the planning and co-ordination of social work.

National and local agencies and sources of information are given in each chapter. Some important sources of factual material which are not mentioned, however, are the Real Property Inventories for 64 cities published in 1934 by the Department of Commerce and other Inventories published in 300 cities by local or national organizations. These are valuable for the wide variety of information presented and, for some cities, for the arrangement of material by census tracts.

While this book is not intended as a text dealing with community problems, it does present well the broad outlines of each subject. The list of references is sufficient to fill in much of the detail. The author encourages the layman to make descriptive studies but wisely advises against evaluating or appraising community performance without the close supervision of trained and competent specialists. This splendid work should prove to be more widely useful than the 54,000 copies of Miss Byington's pamphlet which have been distributed to students of community life.

Harold E. Adams

Western Reserve University

Farm Credit in Canada, by W. T. Easterbrook, with a foreword by H. A. Innis. Chicago: University of Chicago Press. Canada: University of Toronto Press. Political Economy Series, No. 2. 1938. viii, 260 pp. $2.50.

This volume, the second in a series of studies in the economic development of Canada published by the Maurice Cody Foundation and the University of Toronto Press, is a notable contribution to Canadian economics. The purpose of the study is to ascertain "the possibilities and limitations of government intervention in the provision of farm credit." The approach is

historical, and the survey of Canadian economic development in its relation to problems of farm finance serves as a background to the detailed study of government intervention in this field in the postwar period.

In Part I of the study, Dr. Easterbrook traces the significant factors in Canadian economic history in their relation to the financing of Canadian agriculture prior to 1917. These factors are traced through the pre-Confederation period (prior to 1867) and in the developments in the St. Lawrence region and in the western provinces in the post-Confederation period. The significant factors in Canadian economic history from the standpoint of agricultural finance "have been the subservience of agriculture to other industries and interests over a long period, and the importance of state action to the country's development. The first was due partly to the nature and location of the country's natural resources and partly to the demands of the overseas markets; the second was largely a result of Canada's late arrival in the industrial world. The consequences were apparent in the character of the early financial institutions and in the stimulus resulting from state aid" (page 61). During the period dominated by the fisheries, the fur trade, and lumbering the financial structure developed with scant attention to agriculture. Government intervention was mainly for military and developmental purposes, with the consequence that Government support served indirectly to stimulate agricultural development and make it a profitable field of investment with little need for direct financial aid. In spite of the development of credit institutions, however, the credit system as a whole was at best a makeshift in so far as agriculture was concerned; there was little attempt to provide a form of credit specifically suited to the farmers' needs. Such a system served very well as long as agricultural expansion persisted. The defects became apparent when expansion ended, and it was inevitable that other methods would then be tried. "With the slowing down of expansion, and the appearance of serious maladjustments in production and marketing in the war and post-war years . . . the pressure for state action became acute" (page 158).

In Part II, Government intervention in farm lending is studied mainly with reference to the postwar years. This part of the volume deals with intervention by the various provincial governments and by the Federal Government and includes a chapter on provincial and Federal debt adjustment measures. In these chapters the difficulties of developing a type of credit organization adequate to meet the problems associated with the decline in the rate of expansion are suggested. In the final chapter, Dr. Easterbrook gives a summary of the implications of past developments and suggests the lines along which Government intervention in farm finance may be profitably extended.

W. J. WAINES

University of Manitoba

Rural Youth: Their Situation and Prospects, by Bruce L. Melvin and Elna N. Smith. Washington, D. C. Division of Social Research, Works Progress Administration. Research Monograph XV. 1938. xx, 167 pp.

This worthy monograph consists of a general treatment of the circumstances surrounding American rural youth (aged 16–24) years and the problems confronting them. It is based upon official statistics and the findings of numerous special studies. The authors see the long-time rural youth problem to be "that of an excess in numbers in relation to a dearth of rural opportunities, a situation which becomes greatly aggravated during 'hard' times." They review the familiar facts relative to rural and urban birth rates, marriage rates, and migration. They show, as have others before them, that the effect of economic depression is to cause rural youth to "pile up" in the country. They stress the fact that the number of youth in the United States will reach the maximum between 1940 and 1945.

In their discussion of the economic status of rural youth, the authors rightly show dissatisfaction with the current concepts of unemployment as applied to the people who live on farms. They distinguish three economic groups but lack the facts to show the relative importance and distribution of each: (1) those gainfully and advantageously occupied or otherwise advantageously situated; (2) those who have remained above the relief level but whose situation is precarious; and (3) those who are at the relief level. The authors conclude that there are too many young people living on farms and in villages and that the outlook for economic opportunity in agriculture is growing worse because of (1) the growing burden of farm indebtedness, (2) increasing farm tenancy, (3) decreasing demand for farm laborers, (4) the trend toward large-scale land ownership, (5) mechanization of agriculture, and (6) the growth of areas of agricultural maladjustment. Consequently, large numbers of rural youth must (1) remain in rural territory at a low level of living, (2) go to cities, usually at low wages, or (3) go on relief or accept Government jobs.

The review of the evidence showing the inadequacy of the educational and recreational facilities available for rural youth is done in a convincing manner. In the discussion of the problem of meeting the needs of rural youth, an impressive array of agencies, both governmental and nongovernmental, is paraded before the reader, together with their programs. One can scarcely help being impressed with the fact that much is already being done for rural youth. In fact, the current interest in the problems of youth is such that it is easier, perhaps, to interest agencies in the promotion of a youth program than it is to make certain that the program will be helpful. The authors rightly emphasize, however, that least is being done in those areas where the relative number of rural youth is greatest and where the need is most imperative.

The fundamental problem, however, remains. In the absence of a land frontier, with the exceptionally large number of young people maturing, and the relative scarcity of economic opportunity in nonagricultural occupa-

tions, a surplus of man power exists which no serious-minded student can ignore. The authors of this monograph have performed a service in placing this situation more clearly before us.

C. E. LIVELY

University of Missouri

Economic Aspects of Medical Services, with Special Reference to Conditions in California, by Paul A. Dodd and E. F. Penrose. Washington, D. C: Graphic Arts Press, Inc. 1939. xxii, 499 pp. $3.75.

The material which is presented in this study was gathered in the course of the California Medical-Economic Survey, a project sponsored originally by the California Medical Association and financed jointly by that organization and by state and Federal funds provided through the State Emergency Relief Administration. While the data refer largely to the situation in that one state, the results are of significance for similar problems elsewhere.

The statistical data were obtained primarily through the use of schedules filled out by interviewers in the home or, in the case of practitioners of medicine and dentistry, sent through the mail. From the returns, it was possible to present figures indicating, *inter alia*, reported needs for medical care, amount of illness diagnosed but untreated, amount of care received, payments made for this care, and incomes and professional expenditures of physicians and dentists. The procedures which were applied are clearly and fully described, and the compilation and interpretation of the data have been carefully done throughout.

In general, the results of this study confirm the broad findings of earlier inquiries, such as those of the Committee on the Costs of Medical Care. The positive correlation between income and receipt of medical care, the variation in professional incomes with degree of specialization and with size of community, the relative importance of payments for medical care in family expenditures—these and other features of the general pattern may now be considered as solidly established.

After presentation of the statistical data the authors discuss existing public health activities in California. The principal recommendations center about the improvement and extension of public health work and the inauguration of a system of compulsory health insurance.

The conclusions of any careful study in a controversial field are almost bound to evoke some protests from a reviewer. Specifically, it may be suggested that too little attention has been given to the peculiar problems of including dentistry in the scope of a health insurance plan. Again, one may wonder whether it is profitable to belabor the concept of insurance to the extent necessary to justify its use as applied to health services. But these, if defects, are minor ones and are far outweighed by the merits of the study. Two points may be given special mention. The authors give due recognition not only to the importance of public health services but also—and this is rare in discussions of health insurance—to the importance of not framing an

insurance plan that will preclude or impede further developments in these services. They take their stand also against the curious thesis, quite fashionable a few years ago, that administrative problems would somehow be simplified if cash benefits for disability due to ill health were placed under the unemployment compensation laws.

Combining as it does a thorough statistical investigation with careful analysis of the problems involved, this report can be highly recommended to all those who are interested in the economic aspects of health and medical care.

DOUGLASS V. BROWN

Massachusetts Institute of Technology

PUBLICATIONS RECEIVED

ABRAMOVITZ, MOSES. An Approach to a Price Theory for a Changing Economy. New York: Columbia University Press. London: P. S. King & Son, Ltd. 1939. 158 pp. $2.50.

THE ACTUARIAL SOCIETY OF AMERICA AND THE ASSOCIATION OF LIFE INSURANCE MEDICAL DIRECTORS. Impairment Study, 1938. 1939. 43 pp.

BARFOD, BARGE. Local Economic Effects of a Large-Scale Industrial Undertaking. Copenhagen: Einar Munksgaard. London: Humphrey Milford, Oxford University Press. 1938. 74 pp. 3/6.

BARNES, IRSTON R. Cases on Public Utility Regulation. New York: F. S. Crofts & Company. 1938. xx, 984 pp. $7.00.

BENNETT, M. K. Seasonal Aspects of the European Wheat Trade. Stanford University, California: Food Research Institute. March, 1939. pp. 297–335. 75 cents.

BROOKINGS INSTITUTION. Reorganization of the National Government: Part I, An Analysis of the Problem, by Lewis Meriam. Part II, A Brief History of Reorganization Efforts, by Laurence F. Schmeckebier. Washington, D. C. 1939. xii, 272 pp. $2.00.

BRUCK, W. F. Social and Economic History of Germany from William II to Hitler, 1888–1938. Cardiff: University of Wales Press Board. London: Oxford University Press. 1938. xv, 292 pp. 12/6.

COLE, ARTHUR HARRISON. Wholesale Commodity Prices in the United States 1700–1861. Cambridge: Harvard University Press. London: Humphrey Milford, Oxford University Press. 1938. xxiii, 187 pp. $4.00.

—— Wholesale Commodity Prices in the United States 1700–1861, Statistical Supplement. Cambridge: Harvard University Press. London: Humphrey Milford, Oxford University Press. 1938. x, 359 pp. $2.50.

COMMITTEE FOR THE STUDY OF FEDERAL AND STATE STOCK TRANSFER TAXES. Preliminary Report. The Problem of Stock Transfer Taxation in the State of New York. New York City. 1939. vi, 62 pp.

CONGRÈS INTERNATIONAL DE LA POPULATION, PARIS, 1937. Tome IV: Démographie Statistique: Études Spéciales (État de la Population, Migrations). 147 pp. Tome V: Démographie Statistique: Études Spéciales (Natalité, Nuptialité, Mortalité). 248 pp. Tome VII: Facteurs et Conséquences de l'Évolution Démographique. 212 pp. Tome VIII: Problèmes Qualitatifs de la Population. 258 pp. Paris: Hermann et Cie, Éditeurs. Washington: Population Association of America. 1938.

CRAWFORD, FINLA GOFF. Motor Fuel Taxation in the United States. Syracuse, New York: Published by the Author. 1939. x, 134 pp. $1.00.

DAVIS, JOSEPH S. On Agricultural Policy, 1926–1938. Stanford University, California: Food Research Institute. 1939. viii, 494 pp. $3.00.

DIETRICH, ETHEL B. World Trade. New York: Henry Holt and Company. 1939. vi, 458 pp. $2.75.

DODD, PAUL A. and PENROSE, E. F. Economic Aspects of Medical Services, with Special Reference to Conditions in California. Washington, D. C.: Graphic Arts Press, Inc. 1939. xxii, 499 pp. $3.75.

DUNLAP, JACK W. Workbook in Statistical Method, With Special Reference to the Social Sciences. New York: Prentice-Hall, Inc. 1939. ix, 145 pp. $1.75.

FARNAM, HENRY W. Chapters in the History of Social Legislation in the United States to 1860. Washington, D. C.: Carnege Institution of Washington. 1938. xx, 496 pp. $2.25.

FARNSWORTH, HELEN C. and WORKING, HOLBROOK. World Wheat Survey and Outlook January 1939. Stanford University, California: Food Research Institute. January, 1939. pp. 259–96. 75 cents.

FELDMAN, HERMAN and SMITH, DONALD M. The Case for Experience Rating in Unemployment Compensation and a Proposed Method. New York: Industrial Relations Counselors, Inc. 1939. viii, 66 pp. $1.00.

FORD, ROBERT S., with the collaboration of William B. Wood. Taxation of Intangibles in Michigan. Ann Arbor: Bureau of Government, University of Michigan. 1939. ix, 156 pp.

GILBERT, MILTON. Currency Depreciation and Monetary Policy. Philadelphia: University of Pennsylvania Press. London: Humphrey Milford. 1939. xiii, 167 pp. $2.00.

GOULDEN, C. H. Methods of Statistical Analysis. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1939. vii, 277 pp. $3.50.

GREEN, HOWARD WHIPPLE. Natural Increase and Migration, Greater Cleveland, 1919–1937. Cleveland: Cleveland Health Council. 1938. 75 pp. $1.00.

GRIFFIN, JOHN I. Strikes, A Study in Quantitative Economics. New York: Columbia University Press. London: P. S. King & Son, Ltd. 1939. 319 pp. $4.00.

HARDY, CHARLES O. Odd-Lot Trading on the New York Stock Exchange. Washington, D. C.: The Institute of Economics of The Brookings Institution. 1939. x, 192 pp. $1.50.

HARWOOD, E. C. Cause and Control of the Business Cycle. Cambridge, Massachusetts: American Institute for Economic Research. Second Edition, 1939. vii, 224 pp. $2.00. (First edition was reviewed in June, 1933, issue of this JOURNAL.)

INNES, JOHN W. Class Fertility Trends in England and Wales, 1876–1934. Princeton: Princeton University Press. 1938. xiii, 152 pp. $2.50.

KELLER, EDWARD A. A Study of the Physical Assets, Sometimes Called Wealth, of the United States 1922–1933. Notre Dame, Indiana: Bureau of Economic Research, University of Notre Dame. 1939. 140 pp.

KURTZ, RUSSELL H. Editor. Social Work Year Book 1939, A Description of Organized Activities in Social Work and in Related Fields. New York: Russell Sage Foundation. Fifth Issue, 1939. 730 pp. $3.50.

KUZNETS, SIMON and FRIEDMAN, MILTON. Incomes from Independent Professional Practice, 1929–1936. New York: National Bureau of Economic Research. 1939. 32 pp. 50 cents.

LEAGUE OF NATIONS. Balances of Payments 1937. Geneva: League of Nations. Economic Intelligence Service. New York: Columbia University Press. 1938. 212 pp.

—— International Trade Statistics 1937. Geneva. New York: Columbia University Press. 1938. 450 pp. $3.00. (French and English text.)

—— Survey of National Nutrition Policies 1937/38. Geneva. New York: Columbia University Press. 1938. 120 pp. 60 cents.

LEAVENS, DICKSON H. Silver Money. Bloomington, Indiana: Principia Press, Inc. 1939. xix, 439 pp. $4.00.

LEVINSON, HORACE C. Your Chance to Win: The Laws of Chance and Probability. New York and Toronto: Farrar & Rinehart, Inc. 1939. 343 pp. $2.50.

LYND, ROBERT S. Knowledge for What? Princeton: Princeton University Press. 1939. x, 268 pp. $2.50.

LYNSKY, MYER. Sugar Economics, Statistics, and Documents. New

York: United States Cane Sugar Refiners' Association. 1938. xiii, 305 pp.

Martin, James, *et al.* Tax Exemptions. New York: Tax Policy League, Inc. 1939. vii, 237 pp. $3.00.

Michigan, University of, Bureau of Business Research. Bond Investment Policies for Banks—Proceedings of the First Annual Michigan Bankers Association Study Conference, Ann Arbor, December 9 and 10, 1938. 34 pp. $1.00.

Neyman, J. and Pearson, E. S. Editors. Statistical Research Memoirs, Volume II. London: Department of Statistics, University College. December, 1938. 149 pp. 15*s*.

Pearson, E. S. Karl Pearson, An Appreciation of Some Aspects of His Life and Work. Cambridge: University Press. New York: The Macmillan Company. 1938. viii, 170 pp. $3.75.

Pollock, Horatio M., Malzberg, Benjamin, and Fuller, Raymond G. Hereditary and Environmental Factors in the Causation of Manic-Depressive Psychoses and Dementia Praecox. Utica, New York: State Hospitals Press. 1939. 473 pp. $2.50.

Schmalz, Carl N. Operating Results of Consumer Co-operatives in the United States in 1937. Boston: Harvard University. March, 1939. v, 37 pp. $1.00.

Sinai, Nathan, *et al.* Medical Relief in Michigan, A Study of the Experience in Ten Counties. Ann Arbor, Michigan: Edwards Brothers, Inc. 1938. iv, 146 pp.

Smith, Charles Edward and Moorhead, Paul Grady. A Short History of the Ancient World. New York and London: D. Appleton-Century Company, Inc. 1939. xvii, 653 pp. $3.75.

Tannenbaum, Robert. Cost under the Unfair Practices Acts. Chicago: University of Chicago Press. 1939. ix, 65 pp. $1.00.

Turner, Robert C. Member-Bank Borrowing. Columbus, Ohio: The Ohio State University. December, 1938. xiv, 243 pp.

von Mises, Richard. Probability, Statistics and Truth. London: William Hodge and Company, Limited. 1939. xvi, 323 pp. 12/6.

Welfling, Weldon. Savings Banking in New York State. Durham, North Carolina: Duke University Press. 1939. xiv, 205 pp. $3.00.

White, Leonard D. Introduction to the Study of Public Administration. New York: The Macmillan Company. Revised Edition, 1939. xiii, 611 pp. $4.00.

Wilhelms, Carl. Die Übererzeugung im Ruhrkohlenbergbau 1913 bis 1932. Jena: Verlag von Gustav Fischer. 1938. viii, 276 pp. Rm. 12.–.

Williams, Edward Ainsworth. Federal Aid for Relief. New York: Columbia University Press. London: P. S. King & Son, Ltd. 1939. 269 pp. $3.25.

Woytinsky, W. S. Seasonal Variations in Employment in the United States. New York: Social Science Research Council. 1939. x, 154 pp. $1.50.

Young, Pauline V. Scientific Social Surveys and Research. New York: Prentice-Hall, Inc. 1939. xxix, 619 pp. $3.00.

Government Publications

Department of Agriculture. A Graphic Summary of Farm Animals and Animal Products, by O. E. Baker. 1939. 88 pp.

—— Bureau of Agricultural Economics. Barriers to Internal Trade in Farm Products, by George R. Taylor. March, 1939. vi, 104 pp.

Department of Labor, Bureau of Labor Statistics. Consumers' Co-operation in the United States, 1936, prepared by Florence E. Parker. Bulletin No. 659. 1939. 207 pp.

—— Family Income in Chicago, 1935–36. Bulletin No. 642, Volume I. 1939. 210 pp.

—— Mechanization and Productivity of Labor in the Cigar Manufacturing Industry. Bulletin No. 660. 1939. 66 pp. 15 cents.

Department of the Treasury, United States Public Health Service. National Health Survey, Hearing Study Series, Bulletins 4, 5, 6, and 7. 1938. 18, 20, 31, and 35 pp.

Interstate Commerce Commission. Railroad Sinking Funds and Funded Debt, by W. H. S. Stevens. 1939. 131 pp. 20 cents.

National Resources Committee. Research—A National Resource.

I. Relation of the Federal Government to Research. Report of the Science Committee to the National Resources Committee. 1938. 255 pp. 50 cents.

—— Urban Government. Vol. I. 1939. 303 pp. 50 cents.

SECURITIES AND EXCHANGE COMMISSION. Investment Trusts and Investment Companies. Part Two: Statistical Survey of Investment Trusts and Investment Companies. Volume IV, Chapter VI: Performance of Large Management Investment Companies Proper, 1927–1937. 1939. 130 pp. Volume V, Chapter VII: Investors' Experience in Investment Trusts and Investment Companies. 1939. 21 pp. Volume VI, Chapter VIII: Portfolio Investments of Investment Trusts and Investment Companies. 1939. 177 pp.

—— Selected Information on Automobile Manufacturers, Registered under the Securities Exchange Act of 1934 at June 30, 1938. 1939. 57 pp. Corresponding publications received for Chain Variety Stores, Cigarette Manufacturers with Assets over $10,000,000 Each, Mail Order Houses, Manufactures of Agricultural Machinery and Implements, Manufacturers of Office Machinery and Equipment, Manufacturers of Tires and Other Rubber Products, Oil Refiners with Producing Facilities Having Assets over $50,000,000 Each and Sugar Refiners—Beet-Cane.

SOCIAL SECURITY BOARD, BUREAU OF PUBLIC ASSISTANCE. Characteristics of State Plans for Old-Age Assistance. Revised June 30, 1938. 51 pp.

—— Characteristics of State Plans for Aid to Dependent Children. Revised June 30, 1938. 41 pp.

—— Characteristics of State Plans for Aid to the Blind. Revised June 30, 1938. 33 pp.

UNITED STATES TARIFF COMMISSION. Changes in Import Duties Since the Passage of the Tariff Act of 1930. Miscellaneous Series, January 1, 1939. 1939. 171 pp. 45 cents.

——Trade Agreement Between The United States and the United Kingdom. Digests of Trade Data with Respect to Products on Which Concessions Were Granted by the United States Volume IV. Schedule 3—Metals and Manufactures of. 1938. 205 pp.

WORKS PROGRESS ADMINISTRATION, DIVISON OF RESEARCH. Former Relief Cases in Private Employment, by Joseph C. Bevis and Stanley L. Payne. 1939. 23 pp.

—— Michigan Migrants, by Albert Westefeld. 1939. 35 pp.

—— Five Years of Rural Research, by Waller Wynne, Jr. 1938. 160 pp.

—— Low Income Housing Area Survey. 1939. 247 pp.

—— NATIONAL RESEARCH PROJECT. Changes in Farm Power and Equipment: Tractors, Truck, and Automobiles. 1938. 114 pp.

—— Decasualization of Longshore Work in San Francisco, Methods and Results of the Control of Dispatching and Hours Worked, 1935–37, by Marvel Keller. 1939. 157 pp.

—— Reemployment of Philadelphia Hosiery Workers after Shut-downs in 1933–34, by Gladys L. Palmer and Constance Williams. 1939. 100 pp.

—— NATONAL RESEARCH PROJECT AND NATIONAL BUREAU OF ECONOMIC RESEARCH. Productivity and Employment in Selected Industries: Brick and Tile, Report No. N-2, by Miriam E. West. 1939. 212 pp.

WORKS PROGRESS ADMINISTRATION FOR THE CITY OF NEW YORK. Reports on Public Assistance to the Administrator of the Advisory Council. New York. 1939. 268 pp.

WISCONSIN CROP REPORTING SERVICE. Wisconsin Agriculture. Statistical Bulletin No. 188. Madison. 1938. 101 pp.

GREAT BRITAIN. Statistical Abstract for the United Kingdom. London: His Majesty's Stationery Office. New York: The British Library of Informaton. Eighty-second number, 1939. 453 pp. $2.00.